

Regulations for the study program

Computer Science

Master of Science (M.Sc.)

Implementation terms with appendices

I: Study and examination plan

II: Competence descriptions

III: Module Description Handbook (*only published electronically*)

Resolution of the Faculty Council on 31.03.2022
Entry into force of the Regulations on 01.10.2023



TECHNISCHE
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INFORMATION:

This translation is not an official document. It is a service for our international students and prospective students.

The English translation is for information purpose only.
The legally binding document is the German version.

Based on the approval of the Presidential Board of the TU Darmstadt dated 2023.05.11 (Ref.: 652-7-1), the regulations of the study programme Computer Science (M.Sc.) (Department of Computer Science) dated 2023.02.09 concerning the General Examination Regulations of the TU Darmstadt (APB) are published.

Darmstadt, 11.05.2023
The President of the TU Darmstadt Professor
Dr. Tanja Brühl

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Preamble

On 09.02.2023, the Faculty Council of the Department of Computer Science, in accordance with § 3 Para. 1 of the General Examination Regulations of the TU Darmstadt (APB), approved the following regulations for the Computer Science Master of Science (M.Sc.) study program with the following components

1. Appendix I Study and examination plan
 2. Appendix II Competence descriptions
 3. Appendix III Module Description Handbook
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Article 1

Implementation terms

for § 2 (1): Degree

The Computer Science (M.Sc.) study program is maintained by the Department of Computer Science at TU Darmstadt. The Technical University Darmstadt awards the academic degree Master of Science once the 120 credit points (CP) required for the study program have been achieved.

for § 3 (4): Timing of the examinations

It is recommended that all examinations are taken in the order and semester as suggested in Appendix I.

for § 5 (3), (4): Modules, components and type of examination

In Appendix I of these regulations, the study and examination plan, specifies the type, the scope, the number and the form or category of the examination as well as the weighting with which these are included in the overall grade of the module.

Examinations taken in other departments are aligned according to the regulations of the offering departments of TU Darmstadt.

for § 7 (1): Examination boards – joint examination board of consecutive Bachelor's / Master's study programs

A joint examination board is established for the study program Computer Science (M.Sc.) and the study programs Informatik (B.Sc.), Informatik (M.Sc.), Autonome Systeme und Robotik (M.Sc.) and Artificial Intelligence and Machine Learning (M.Sc.).

for § 11 (5): General admission requirements - language of instruction

The language of instruction for the study program is English.

Individual courses/modules may be offered in German. This is indicated in the module description.

It is to be assumed that scientific literature is also to be read and processed in German

for § 17a (1): Admission requirements for Master's programs

In the following, the admission requirements for the Master's program Computer Science (M.Sc.) and, in particular, the previous knowledge and qualifications (entry competencies) required by the applicants are specified.

Applications for the Master's program Computer Science (M.Sc.) are possible for applicants for a winter semester until July 15th of the year (cut-off deadline) and until January 15th of the year for a summer semester (cut-off deadline).

for § 17a (2): Entry competencies for a consecutive Master's program

The entry competencies for the consecutive Master's program Computer Science (M.Sc.) result from the competence profile of the Bachelor's program Informatik (B.Sc.) of TU Darmstadt as the reference study program entitling to the Master's program.

The admission requirement for the Master's program Computer Science (M.Sc.) is a Bachelor's degree in Informatik (B.Sc.) from the TU Darmstadt or a degree in a study program which imparts competencies amounting to at least 180 CP, of which at least 60 CP are not significantly different from the entry competencies taught in the reference study program (comparable study program).

Details on the entry competencies taught in the reference study program at TU Darmstadt are provided in the competence description in Appendix II.

for § 17a (4) a) and b): Formal entrance examination

During the formal entrance examination, the proof of the required entrance competencies is verified on the basis of the documents to be submitted by the applicants.

The following documents must be submitted: the certificate of the first degree and the Diploma Supplement or comparable documents of the study program leading to the first degree.

for § 17a (4) c) (5): Substantive Entrance Examination

If the entrance competencies could not be clearly clarified positively or negatively within the formal entrance examination, a substantive entrance examination is then conducted.

The entrance examination cannot be repeated in this application procedure.

Within the substantive entrance examination, an oral examination lasting 30 minutes will be conducted on the premises of the TU Darmstadt or via video telephony, which is harmless in terms of data protection.

If it is foreseeable during the application period that more than 10 applicants will have to take a substantive entrance examination or that a video telephone call cannot be carried out properly, the examination board may decide that the suitability of the candidates will be checked instead by a written examination lasting 90 minutes on the premises of the Technische Universität Darmstadt or by a written examination as an online test.

The examination board determines the form and time of the substantive entrance examination and appoints examiners. The examiners determine the content of the examination with the aim of establishing the applicant's suitability for the M.Sc. Computer Science study program at TU Darmstadt.

The examination board may exempt an applicant from the substantive entrance examination if it is to be expected that he or she will successfully complete the Master's program on the basis of an admission and aptitude test of another university or a private provider with corresponding standards (e.g. GRE or comparable tests).

for § 17a (8): Conditional Admission

If, after the entrance examination, it is found that the applicant lacks entrance competencies that can be compensated for by completing credits amounting to no more than 30 CP, a conditional admission may

be granted. The letter of admission lists the modules or subject examinations that are imposed and by when they must be completed.

The conditions are governed by the General Examination Regulations (APB) of Technical University of Darmstadt with the exception of the second repeat examination in accordance with Section 31 APB and the oral supplementary examination in accordance with Section 32 APB, i.e. only two attempts per condition are permitted.

for § 18: Admission requirements

The admission requirements for examinations or modules, if any, are set out in Appendix I to these implementing regulations, the study and examination plan, and in Appendix III, the module descriptions.

for § 22 (1): Conduct of the examinations - Duration of the oral examination

The duration of the oral examination (at least 15 min. per person and examination) is specified in each case in Appendix I to these implementing regulations, the study and examination plan.

for § 22 (5): Conduct of the examinations - duration of proctored examinations

The duration of the proctored examinations (at least 45 min.) is specified in each case in Appendix I to these implementation provisions, the study and examination plan.

for § 22 (6): Conduct of examinations - special forms of examinations

The duration of the examination is specified in Appendix I to these implementation provisions, the study and examination plan, in accordance with § 22 (1) and (5) APB.

for § 23 (5): Thesis - processing time

The thesis comprises a workload of 30 CP (900 hours) and must be completed and submitted within 26 weeks.

for § 25 (1), (3): Formation and weighting of grades

The grading system for each examination performance is set out in Appendix I to these implementing provisions, the study and examination plan. The study and examination plan also specifies the weighting with which the grades of the subject examinations and coursework are included in the module grade.

for § 28 (2): Overall grade

Appendix I of these implementation provisions, the study and examination plan, specifies the weighting of the module grades in the overall grade. Unless otherwise specified in Appendix I, the module grades shall be included in the overall grade according to the credit points acquired in the modules.

for § 30 (4): Repetition of the examination - change of a focal point

The specialization in Computer Science (M.Sc.) can be changed once upon application for good cause

Article 2

Appendixes

Appendix I Study and Examination Plan

Master degree programm

Computer Science (M.Sc.)



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Study and examination plan (Appendix I)



Key	Examination components	Course	Semester			
			1.	2.	3.	4.
Grading system	St= Standard (graded); bnb= passed/not passed					
Forms of examinations	A = submission, B = report, E = essay, H = research assignment, HÜ = homework, worksheets, K = written exam, Kq = colloquium, M = oral examination as specified in module description, mP = oral examination, M/S = oral/written examination as specified in module description, P = log, Pt = presentation, R = seminar paper, S = written examination as specified in module description, SF = special form, Th = thesis					
Status:	o= compulsory; f= optional					
Forms of teaching	VL=Lecture; S=Seminar; Ü=tutorial; iV= integrated lecture; VÜ=lecture and tutorial; PR=Lab; ...					
Compulsory attendance:	yes = courses with compulsory attendance according to §11 (6) APB, except lectures, justification in the module description. MHB = see module handbook, modules with compulsory attendance in this area, if applicable.					
Grade improvement attempt (optional):	x = A grade improvement attempt in accordance with § 30 (1a) APB is only possible in the examination(s) correspondingly marked with x.					
Prerequisite for admission	MHB: see module handbook, for this examination or module there is a prerequisite for admission according to §18 APB.					
CP:	Credi Point					
TUCaN number and assignment of CPs to module elements are informative in nature. The CPs are given once the module is completed.						
Prerequisite for admission Subject examinations (Fachprüfungen) Study credits (Studienleistungen) Form of examination Grade improvement attempt in accordance with § 30 (1a) APB Duration (min) Weighting for module grade (%) Weighting for overall grade (factor) Contact hours per week (SWS) Status Form of teaching Compulsory attendance Total CPs						
Elective Areas, Specializations and Generale Education						
90						
30 30 30						
A Elective Areas & Specializations (open catalogues)						
66-72 66-72						
A.1 Core Course Catalogues (open catalogues) (Type § 30 Abs. 5 APB) min. 12 CP - max. 18 CPs						
12-18 12-18						
Software & Hardware						
o						
Software & Hardware						
1 o 6-12 6-12						
Theory						
o						
Theory						
1 o 6-12 6-12						
A.2 Specializations (Type § 30 Abs. 4 APB) Choice of exactly one specialization min. 54 CP - max. 60 CPs						
54-60 54-60						
Specialization Data Science and Engineering min. 54 CP - max. 60 CP						
f 54-60 54-60						
Elective Areas (Type § 30 Abs. 5 APB) Subject examinations from the elective areas of the specializaion Data Science and Engineering. Examination form and duration according to the specifications of the department offering the course. Open catalogues min. 42 CPs - 48 CPs						
o 42-48 42-48						
Foundations of Data Science						
o						
Foundations of Data Science						
1 o 12-24 12-24						
Data Systems Engineering						
o						
Data Systems Engineering						
1 o 12-24 12-24						
Data Science Applications						
o						
Data Science Applications						
1 o 12-24 12-24						
Seminars, Labs, Practical Labs in Teaching (Type § 30 Abs. 6 APB). Choice from the listed catalogues of the specialization Data Science and Engineering. Examination form and duration according to the specifications of the department offering the course. Open cataloguesmin. 12 CP - max. 18 CP						
o 12-18 12-18						
Seminare (min. 1)						
1 o 3-12 3-12						
Practical lab in teaching (max. 1)						
1 f 0-5 0-5						
Lab, Project Lab, etc. (min. 1)						
1 o 6-15 6-15						
Research Paper						
1 f 0-9 0-9						

Specialization Distributed Computing min. 54 CP - max. 60 CP										f					54-60	54-60			
Elective Areas (Type § 30 Abs. 5 APB) Subject examinations from the elective areas of the specializaion Distributed Computing. Examination form and duration according to the specifications of the department offering the course. Open catalogues min. 42 CPs - 48 CPs										o					42-48	42-48			
Computer Networks and Distributed Systems										o									
Computer Networks and Distributed Systems										1	o				12-30	12-30			
Data-Intensive Systems and heterogeneous Hardware										o									
Data-Intensive Systems and heterogeneous Hardware										1	o				12-30	12-30			
System Modelling and Engineering										o									
System Modelling and Engineering										1	o				6-24	6-24			
Seminars, Labs, Practical Labs in Teaching (Type § 30 Abs. 6 APB). Choice from the listed catalogues of the specialization Distributed Computing. Examination form and duration according to the specifications of the department offering the course. Open cataloguesmin. 12 CP - max. 18 CP										o					12-18	12-18			
Seminare (min. 1)										1	o				3-12	3-12			
Practical lab in teaching (max. 1)										1	f				0-5	0-5			
Lab, Project Lab, etc. (min. 1)										1	o				6-15	6-15			
Research Paper										1	f				0-9	0-9			
Specialization Visual Computing min. 54 CP - max. 60 CP										f					54-60	54-60			
Elective Areas (Type § 30 Abs. 5 APB) Subject examinations from the elective areas of the specializaion Visual Computing. Examination form and duration according to the specifications of the department offering the course. Open catalogues min. 42 CPs - 48 CPs										o					42-48	42-48			
Computer Graphics										o									
Computer Graphics										1	o				12-30	12-30			
Computer Vision and Machine Learning										o									
Computer Vision and Machine Learning										1	o				12-30	12-30			
Integrated Methods of Graphics and Vision										o									
Integrated Methods of Graphics and Vision										1	o				6-24	6-24			
Seminars, Labs, Practical Labs in Teaching (Type § 30 Abs. 6 APB). Choice from the listed catalogues of the specialization Visual Computing. Examination form and duration according to the specifications of the department offering the course. Open cataloguesmin. 12 CP - max. 18 CP										o					12-18	12-18			
Seminare (min. 1)										1	o				3-12	3-12			
Practical lab in teaching (max. 1)										1	f				0-5	0-5			
Lab, Project Lab, etc. (min. 1)										1	o				6-15	6-15			
Research Paper										1	f				0-9	0-9			
further specializations if necessary															...				
B General Education(open catalogue) (Type § 30 Abs. 6 APB) Courses from the overall catalogues of TU Darmstadt except for the Department of Computer Science (other catalogues can be added if necessary). Examination form and duration according to the specifications of the department offering the course. min. 18 CP - max. 24 CP										o					18-24	18-24			
Electives: Languages										f					0-24	0-24			
Gesamtkatalog des Sprachenzentrums										1	f								
Electives: Humanities, Social Science, Economics & Business Administration										f					0-24	0-24			
Gesamtkataloge der Fachbereiche 01, 02, und 03										1	f								
Electives: Environmental Studies, Engineering, Natural Sciences										f					0-24	0-24			
Gesamtkataloge der Fachbereiche 04, 05, 07, 10, 11, 13, 15, 16, 18										1	f								
Master Thesis										o					30				
20-AM-5600 Master Thesis Computer Science									St	Th					1	1	o		
Summe															120	30	30	30	30
v4.0																Stand: 01.03.2023 (JB)			

Appendix II Competence Descriptions

Entry competencies:

The entry competencies described below are essential for the successful completion of the M.Sc. M.Sc. Computer Science. It is a selection of the most important competencies taught in the reference study program at the TU Darmstadt. These also provide the essential prerequisites for the successful continuation of the study program in a subsequent Master's study program.

Within the competencies of at least 180 CP to be proven from their previous degree, applicants for the M.Sc. Computer Science must prove entry competencies of a total of 60 CP from the reference study program or equivalent competencies for an admission.

The following describes the entry competencies for the M.Sc. Computer Science:

- **Theoretical Computer Science:** the ability to use mathematical notations and methods for the foundation of concepts in computer science, in particular for the formal modelling and verification of software and hardware systems. Courses in which these entry-level competencies are taught in the reference study program at TU Darmstadt are: Propositional and Predicate Logic; Automata, Formal Languages and Decidability; Modelling, Specification and Semantics.
- **Practical computer science:** the ability,
 - to independently select the standard algorithms and data structures required for the solution from a problem description according to the functional and non-functional requirements or to construct and assess new algorithms and data structures for solving the problem on the basis of known strategies, if necessary taking parallelism into account.
 - to combine the individual components of a programming language independently and without an analogous example within the framework of a programming task into an overall solution.
 - to solve programming tasks in different, also parallel, programming languages that follow different paradigms, have different application areas and are located on the whole range of abstraction levels.
 - to ensure the quality of the created implementations through formalised test procedures and design methods.
 - to apply this knowledge in practically relevant areas of computer science such as networks and distributed systems, databases, as well as the creation of programming tools themselves. In each case, non-functional aspects, in particular also the security of the IT systems created, should also be taken into account.

These entry-level competencies in practically relevant areas of computer science are taught in the reference study program at the TU Darmstadt in the following courses: Algorithms and Data Structures; Operating Systems; Computer Security; Computer Networks and Distributed Systems; Introduction to Compiler Construction; Introduction to Artificial Intelligence; Functional and Object-oriented Programming Concepts; Formal Methods in Software Design; Information Management; Parallel Programming; Probabilistic Methods in Computer Science; Scientific Computing; Software Engineering; Visual Computing.

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- **Computer engineering:** the ability,
 - to independently combine the individual design principles and basic elements of digital circuits, as introduced separately one after the other in the lectures, into an overall solution within the framework of a hardware design task without using an analogue example.
 - to solve design tasks at different levels of abstraction and from different application areas by means of structured design methods in different description languages and using a spectrum of design tools and evaluate them with regard to suitable quality measures.
 - to understand the interaction of computer, processor and microarchitectures and make appropriate implementation decisions from this for the system and application software level.

Courses in which these entry-level competencies are taught in the reference study program at TU Darmstadt are Digital Design and Computer Organisation.

Qualification goals:

In the more research-oriented English Master of Science study program in Computer Science, students expand and focus their subject-specific and interdisciplinary competencies from a previous Bachelor's program. These competencies are characteristic for the program's requirements and are an essential prerequisite for a subsequent doctorate.

After completing the study program, graduates have specialised in one of the offered specializations in terms of content and subject matter and, depending on the chosen specialization, are able to:

Specialization Data Science and Engineering:

- independently work on complex problems and tasks from the specialization Data Science and Engineering using scientific methods and considering different approaches to solutions with their improved methodological competence,
- further their professional education independently - especially in English - and to work scientifically independently to a large extent.
- learn and apply methods from the field of data science (Foundations of Data Science) and the application (Data Science Applications) according to the current state of research in order to solve advanced tasks, for example in the fields of relational and graph data, language processing (NLP), image processing (computer vision) and robotics,
- continue to apply the current state of the art of methodology in the field of "Data Systems Engineering" to find solutions for scalable and efficient storage and processing of large amounts of data (e.g. through distributed learning algorithms),
- identify and exploit synergies between approaches from the three areas (Data Science Foundations, Data Science Applications and Data Systems Engineering) and use them to solve complex problems in the field of Data Science end-to-end.

Specialization Distributed Computing:

- work independently on complex problems and tasks from the specialization Distributed Computing using scientific methods and considering different approaches to solutions with their improved methodological competence,
- continue their professional education independently - especially in English - and to work scientifically independently to a large extent.
- use methods of distributed computing according to the current state of research in order to solve advanced tasks, for example in the areas of scalable and resilient parallel and distributed systems.
- continue to apply state-of-the-art methods of data-intensive systems as well as heterogeneous hardware systems to find solutions for efficient data storage, transmission and processing,
- recognise and exploit synergies between computer network approaches, distributed systems and data-intensive systems and heterogeneous hardware systems, and apply them in selected distributed computing applications.

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Specialization Visual Computing:

- independently work on complex problems and tasks from the specialization Visual Computing with scientific methods, considering different approaches to solutions, with their improved methodological competence,
- continue their professional education independently - especially in English - and to work scientifically independently to a large extent.
- use methods of computer graphics according to the current state of research in order to solve advanced tasks, for example in the areas of rendering, visualisation or interaction.
- continue to apply the current state of the art in computer vision and machine learning methods to find solutions for complex image processing or image analysis tasks,
- to recognise and use synergies between approaches of computer graphics and computer vision, and to apply these in selected applications of visual computing.

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In addition, graduates - regardless of the chosen specialization - are able to:

- apply the acquired competencies in new and unfamiliar situations with incomplete information and to think in systemic contexts,
- solve tasks and problems with a high level of abstraction and an eye for complex interrelationships,
- communicate and present the results of their analyses or the elaborated solutions to different target groups, also to foreign languages ones,
- to recognise future problems, technologies and scientific developments and to take them into account appropriately in their work,
- organise and carry out complex projects efficiently and work in teams in a target-oriented manner.
- in addition, the students have expanded their skills and experience in self-selected interdisciplinary areas within the framework of the General Education.

In summary, the Master's program differs from the preceding Bachelor's program in Computer Science primarily in that the focus is on solving complex problems with incomplete information, which require a greater capacity for abstraction and thinking in system interrelationships. In addition, there is an increased ability to deal with current research literature as well as the ability to work scientifically in a self-chosen specialization and to independently solve current problems in practice.

Appendix III Module Descriptions

The module descriptions are published electronically as a module handbook in accordance with § 1 Para. (1) of the statutes of the Technische Universität Darmstadt regulating the publication of statutes of the Technische Universität Darmstadt of 18 March 2010.

Article 3

Entry into force

These regulations of the study program come into force on October 1st 2023. They are published in the statute supplement of TU Darmstadt.

Darmstadt, 22 May 2023

The Dean of the Department of Computer Science at TU Darmstadt