Complete version as of 1 October 2019

Curriculum for the
Bachelor's Programme Computer Science
at the Faculty of Mathematics, Computer Science and Physics
at the University of Innsbruck

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§ 1 Allocation of the study programme

According to §54 par. 1 of the Universities' Act 2002, the Bachelor's Programme Computer Science is allocated to the group of engineering studies.

§ 2 Qualification profile

(1) Computer scientists deal with the basics, technologies and applications of systematic and automated information processing. They provide methods and tools for mastering complex systems in natural science, engineering and almost all other areas of human life. To do so, they use both mathematical-formal as well as engineering methods. Computer scientists are in demand worldwide and across industries. Their occupational areas and work fields range from basic research to the development and operation of innovative technologies and new applications.

(2) (2)Graduates of the Bachelor's Programme Computer Science
   – have a broad basic scientific education in computer science and are able to apply what they have learned to practical problems,
   – have acquired proven programming skills, are able to handle digital data and algorithms in a confident fashion and have an understanding of the architectural principles of modern information technology systems,
   – are qualified for working in the field of IT and optimally for a Master's Programme Computer Science at university.

§ 3 Scope and duration

The Bachelor's Programme Computer Science covers 180 ECTS-Credits. This corresponds to a duration of the studies of six semesters. One ECTS-Credit corresponds to a workload of 25 hours.

§ 4 Admission

The admission to the study programme by the Rectorate is regulated by the Universities' Act 2002 on the admission to Bachelor's programmes.

§ 5 Types of courses and maximum number of participants

(1) Courses without continuous performance assessment:
   1. **Lectures** (VO) are courses held in lecture format. They introduce the research areas, methods and schools of thought for a given subject. No maximum number of participants.
   2. **Studies orientation courses (**SL) provide an overview of the study programme and its structure. They give students an objective basis to assess their decision to pursue their chosen subject. Maximum number of participants: 25

(2) Courses with continuous performance assessment:
   1. **Introductory seminars** (PS) introduce students interactively to scientific literature through the treatment of selected issues. They convey knowledge and methods of academic work. Maximum number of participants: 25
   2. **Seminars** (SE) provide in-depth treatment of scientific topics through students' presentations and discussion thereof. Maximum number of participants: 15
   3. **Lectures with practical elements (**VU) focus on the practical treatment of concrete scientific tasks that are discussed during the lecture parts of the course. Maximum number of participants: 25

§ 6 Allocation of places in courses with a limited number of participants

In courses with a limited number of participants, course places are allocated as follows:
   1. Students for whom the study duration would be extended due to the postponement are to be given priority.

2. If the criteria in no. 1 do not suffice, first, students for whom this course is part of a compulsory module are to be given priority, and second, students for whom this course is part of an elective module.

3. If the criteria in no. 1 and 2 do not suffice, the available places are drawn by random.

§ 7 Studies Induction and Orientation Stage

(1) Within the scope of the Studies Induction and Orientation Stage, which takes place in the first semester, the following course examinations must be passed:

1. VO Introduction to Programming (3 hrs./4.5 ECTS-Credits),

2. VO Introduction to Theoretical Computer Science (2 hrs./ 3 ECTS-Credits),

3. SL Introduction to Theoretical Computer Science (1 h./2 ECTS-Credits).

(2) Successful passing of all exams of the Studies Induction and Orientation Stage entitles to passing all further courses and examinations as well as to writing the Bachelor's Thesis.

(3) Before successful completion of the Studies Induction and Orientation Stage courses amounting to 20.5 ECTS-Credits may be passed. The requirements specified in the curriculum must be met.

§ 8 Compulsory and elective modules

(1) The following compulsory modules covering a total of 165 ECTS-Credits must be passed:

1.	Compulsory Module: Introduction to Programming	h	ECTS-Credits
a.	**VO Introduction to Programming**	3	4.5
b.	**PS Introduction to Programming**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: Successful participants of this module understand the most important concepts of imperative programming and can apply them in practice. They have developed the ability to acquire similar concepts independently. They are capable of analysing existing computer programmes and of designing and implementing their own.		
	Prerequisites: none		

2.	Compulsory Module: Introduction to Theoretical Computer Science	h	ECTS-Credits
a.	**VO Introduction to Theoretical Computer Science**	2	3
b.	**SL Introduction to Theoretical Computer Science**	1	2
	Total	**3**	**5**
	Learning Outcomes: Graduates of this module understand the notion of computability theory and various abstract computational models as well as their differences. Furthermore, they can reduce information to its essentials and represent the information abstractly. Moreover the are capable of given formal proofs.		
	Prerequisites: none		

3.	**Compulsory Module: Functional Programming**	**h**	**ECTS-Credits**
a.	**VO Functional Programming**	2	3
b.	**PS Functional Programming**	1	2
	Total	**3**	**5**
	Learning Outcomes: Students understand the differences between imperative and functional programming as well their respective advantages and disadvantages. They know the main concepts of functional programming. Moreover, they learn how to demonstrate the qualities of functional programming.		
	Prerequisites: none		

4.	**Compulsory Module: Linear Algebra**	**h**	**ECTS-Credits**
a.	**VO Linear Algebra**	3	4.5
b.	**PS Linear Algebra**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students are familiar with linear algebra formulations and expressions. They can solve problems in the area of linear algebra with algorithms and formulate variants of these algorithms according to the situation.		
	Prerequisites: none		

5.	**Compulsory Module: Computer Architecture**	**h**	**ECTS-Credits**
a.	**VO Computer Architecture**	2	3
b.	**PS Computer Architecture**	1	2
	Total	**3**	**5**
	Learning Outcomes: After completing this module, students understand the architectural principles and organisational forms of modern computers and are able to write simple Assembler programmes.		
	Prerequisites: none		

6.	**Compulsory Module: Algorithms and Data Structures**	**h**	**ECTS-Credits**
a.	**VO Algorithms and Data Structures**	3	4.5
b.	**PS Algorithms and Data Structures**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students know and understand important algorithms and data structures and master elementary analysis procedures with regard to correctness and resource requirements. They are able to create further data structures and algorithms on their own and to use them in their own programmes.		
	Prerequisites: none		

7.	**Compulsory Module: Applied Mathematics for Computer Science**	h	ECTS-Credits
a.	**VO Applied Mathematics for Computer Science**	3	4.5
b.	**PS Applied Mathematics for Computer Science**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students understand elementary methods of applied mathematics, with a focus on computer science. They are familiar with formulations and expressions, capable to solve relevant problems through targeted application of methods and to work out similar contents themselves.		
	Prerequisites: none		

8.	**Compulsory Module: Operating Systems**	h	ECTS-Credits
a.	**VO Operating Systems**	3	4.5
b.	**PS Operating Systems**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students understand the main concepts of process, thread, memory and file management as well as inter-process communication in operating systems and can apply them. In addition, they have basic knowledge in the areas of virtualisation techniques, linking and loading of programme libraries as well as in system-related programming.		
	Prerequisites: none		

9.	**Compulsory Module: Programming Methodology**	h	ECTS-Credits
a.	**VO Programming Methodology**	3	4.5
b.	**PS Programming Methodology**	2	3
	Total	5	7.5
	Learning Outcomes: After completing this module, students understand the concepts of object-oriented programming and can apply them. They have learnt how to work out similar contents for themselves. They are able to analyse object-oriented programmes and to plan and build their own object-oriented programmes. They have acquired the skills to work out similar contents themselves.		
	Prerequisites: none		

10.	**Compulsory Module: Data and Probabilities**	h	ECTS-Credits
a.	**VO Data and Probabilities**	2	3
b.	**PS Data and Probabilities**	1	2
	Total	**3**	**5**
	Learning Outcomes: After completing this module, students know and understand basic terms and methods of probability theory and statistics. They are able to collect data, draw conclusions from data, prepare		

| | | | them visually and in text form, and assess their reliability, using scientific methods and in compliance with legal and social standards. | | |
| | | **Prerequisites:** none | | | |

11.		**Compulsory Module: Database Systems**	**h**	**ECTS-Credits**
a.	**VO Database Systems**	3	4.5
b.	**PS Database Systems**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students know, understand and apply basic concepts of database systems. Moreover, they are able to implement data modelling at a logical, conceptional and physical level and to formulate queries based on these models.		
	Prerequisites: none		

12.		**Compulsory Module: Discrete Structures**	**h**	**ECTS-Credits**
a.	**VO Discrete Structures**	2	3
b.	**PS Discrete Structures**	1	2
	Total	**3**	**5**
	Learning Outcomes: After completing this module, students know various methods of proof. They understand formal techniques and elementary methods of analysis of discrete structures and can represent information abstractly.		
	Prerequisites: none		

13.		**Compulsory Module: Computer Networks and Internet Technology**	**h**	**ECTS-Credits**
a.	**VO Computer Networks and Internet Technology**	3	4.5
b.	**PS Computer Networks and Internet Technology**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students understand the main concepts of computer communications and know methods for describing and analysing larger networks. They have acquired the skills to independently work out similar content.		
	Prerequisites: none		

14.		**Compulsory Module: Software Architecture**	**h**	**ECTS-Credits**
a.	**VO Software Architecture**	2	3
b.	**PS Software Architecture**	1	2
	Total	**3**	**5**
	Learning Outcomes: After completing this module, students understand the basic organisation of a complex software		

system, represented by its components and their relationships to one another. Moreover, they have skills in designing and implementing such systems.

Prerequisites: none

15.	**Compulsory Module: Introduction to Scientific Work**	h	ECTS-Credits
	VU Introduction to Scientific Work	2	2.5
	Total	**2**	**2.5**

Learning Outcomes:
After completing this module, students know and understand the key concepts and methods of scientific work and can apply them. They have acquired the skills required for writing scientific texts and presenting scientific papers.

Prerequisites: none

16.	**Compulsory Module: Logic**	h	ECTS-Credits
a.	**VO Logic**	3	4.5
b.	**PS Logic**	2	3
	Total	**5**	**7.5**

Learning Outcomes:
After completing this module, students understand logic calculi and can apply them. They have the skill to work out similar content themselves. Moreover, they are able to abstract and model complex problems in formal calculi.

Prerequisites: none

17.	**Compulsory Module: Machine Learning**	h	ECTS-Credits
a.	**VO Machine Learning**	3	4.5
b.	**PS Machine Learning**	2	3
	Total	**5**	**7.5**

Learning Outcomes:
After completing this module, students know and understand important methods of machine learning that allow software systems to independently adjust their parameters based on sample data and/or to continuously optimise their performance. They are able to formalise application problems for machine learning and to solve them using established methods.

Prerequisites: none

18.	**Compulsory Module: Parallel Programming**	h	ECTS-Credits
a.	**VO Parallel Programming**	2	3
b.	**PS Parallel Programming**	1	2
	Total	**3**	**5**

Learning Outcomes:
After completing this module, students know and understand the basic concepts of parallel

systems and parallel programming and can apply them. They are able to develop, optimise and analyse programmes for parallel computers with shared memories in terms of performance. They have acquired the skill to work out similar contents themselves.

Prerequisites: none

19.	**Compulsory Module: Software Engineering**	**h**	**ECTS-Credits**
a.	**VO Software Engineering**	2	2.5
b.	**PS Software Engineering**	2	5
	Total	**4**	**7.5**
	Learning Outcomes: After completing this module, students know and understand the requirements for developing software on an industrial scale. They know the methods and processes of software engineering and can apply them. In addition, they have the skill to analyse software system requirements and create sustainable software solutions. They have acquired skills in teamwork.		
	Prerequisites: none		

20.	**Compulsory Module: Selected Topics**	**h**	**ECTS-Credits**
	Courses corresponding to a total of 15 ECTS-Credits must be selected from the course offer of the university's Faculty of Mathematics, Computer Science and Physics.		15
	Total		**15**
	Learning Outcomes: This module serves the acquisition of additional qualifications.		
	Prerequisites: The prerequisites specified in the respective curricula must be met.		

21.	**Compulsory Module: Specialisation Seminar**	**h**	**ECTS-Credits**
	SE Specialisation Seminar	2	5
	Total	**2**	**5**
	Learning Outcomes: After completing this module, students are able to deal with a subarea of computer science in a methodologically correct manner and to present the results of this examination in writing and orally.		
	Prerequisites: none		

22.	**Compulsory Module: Interdisciplinary Skills**	h	ECTS-Credits
	Providing the availability of places, courses from the curricula of the Bachelor's and/or Diploma studies at the University of Innsbruck may be taken. It is recommended to take a course form the field of gender studies, women's research and gender research.		10
	Total		10
	Learning Outcomes: This module serves the acquisition of additional qualifications.		
	Prerequisites: The prerequisites specified in the respective curricula must be met.		

23.	**Compulsory Module: Bachelor's Thesis**	h	ECTS-Credits
	SE Bachelor's Thesis	1	1 + 14
	Total	**1**	**15**
	Learning Outcomes: After completing this module, students are able to deal with a subarea of computer science in a methodologically correct manner and to present the results of this examination in writing and orally.		
	Prerequisites: none		

(2)   Two elective modules 1 to 4 corresponding to a total of 15 ECTS-Credits must be passed.

1.	**Elective Module: Programme Verification**	h	ECTS-Credits
a.	**VO Programme Verification**	3	4.5
b.	**PS Programme Verification**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students can understand, create and correct the specifications of programmes. They have acquired the skill to prove specifications formally. They use a combination of interactive and automatic methods to combine expressive logic with efficient search for proof.		
	Prerequisites: none		

2.	**Elective Module: Software Quality**	h	ECTS-Credits
a.	**VO Software Quality**	3	4.5
b.	**PS Software Quality**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students know and understand methods and techniques of quality assurance and can apply them in all stages of the software cycle. They can identify quality issues and select appropriate methods, techniques and tools to solve them, as well as target the software lifecycle and to optimise specific quality aspects. They have acquired the skill to independently work out similar contents.		

	Prerequisites: none		

3.	**Elective Module: Distributed Systems**	**h**	**ECTS-Credits**
a.	**VO Distributed Systems**	3	4.5
b.	**PS Distributed Systems**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students know important concepts of distributed systems. They are able to analyse distributed systems in terms of fault tolerance, availability, reliability, performance and scalability. In addition, they have acquired the ability to design, implement and run smaller distributed system applications on distributed systems.		
	Prerequisites: none		

4.	**Elective Module: Visual Computing**	**h**	**ECTS-Credits**
a.	**VO Visual Computing**	3	4.5
b.	**PS Visual Computing**	2	3
	Total	**5**	**7.5**
	Learning Outcomes: After completing this module, students understand elementary methods of visual computing, in particular in image processing and image synthesis. They are able to solve respective problems through targeted use of the methods and to work out similar contents themselves.		
	Prerequisites: none		

§ 9 Bachelor's Thesis

(1) The Bachelor's Thesis is an independent written paper corresponding to a total of 14 ECTS-Credits.

(2) The Bachelor's Thesis is to be written in a subarea of Computer Science within the scope of the module 'Bachelor's Thesis'.

(3) The Bachelor's Theses must be handed in in writing as well as in the electronic form specified by the Director of Studies.

§ 10 Examination regulations

(1) Performance of modules is assessed by module examinations. Module examinations are to proof the knowledge and skills acquired in a module. Once all parts of a module examination are positively passed, the respective module is completed.

(2) Performance of courses of modules is assessed by course examinations. Courses examinations are

1. examinations that assess the knowledge and skills covered by an individual lecture, where the performance is assessed by a single examination at the end of the course. The course lecturer must communicate the examination method (written or oral) before the start of the course.

2. courses with continuous performance assessment, for which the performance assessment is based on regular written and/or oral contributions by the participants.

(3) The course lecturer must communicate the targets, contents and methods of their course as well as the contents, methods and evaluation criteria of the course examinations before the start of each semester.

§ 11 Academic Degree

Graduates of the Bachelor's Programme Computer Sciences are awarded the academic degree "Bachelor of Science", abbreviated "BSc".

§ 12 Coming into force

This curriculum comes into force on 1 October 2019.

§ 13 Transitional provisions

(1) This curriculum applies to all students who were admitted to the Bachelor's Programme Computer Science as of the 2019/2020 winter semester.

(2) Regular students, who have started the Bachelor's Programme Computer Science based on the curriculum of 2007 (University of Innsbruck Bulletin of 23 April 2007, Issue 30, No. 194) before 1 October 2019, are entitled to finish this study programme within eight semesters at the most from this time onwards.

(3) If the Bachelor's Programme Computer Science based on the curriculum of 2007 is not finished in time, the students are subject to the curriculum for the Bachelor's Programme Computer Science in the version published in the University of Innsbruck Bulletin of 27 February 2019, Issue 19, No. 284 (curriculum 2019). Students are also entitled to voluntarily change to the curriculum 2019.