Study and Examination regulations for the bachelor's degree program in Informatics from the Faculty of Mathematics and Informatics at Freie Universität Berlin

Preamble

On the basis of § 14 Par. 1 No. 2 of the Partial Basic Regulations (Trial Model) of Freie Universität Berlin of 27 October 1998 (FU Announcements No. 24/1998), the Department Council of the Faculty of Mathematics and Informations of Freie Universität Berlin on July 16 2014 issued the following Study and Examination Regulations for the Bachelor's Degree Course in Informatics of the Faculties of Mathematics and Informatics of Freie Universität Berlin:*

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§ 1
Scope

.These regulations stipulate the objective, contents and structure of the Bachelor's degree program in Informatics of the Faculties of Mathematics and Informatics of Freie Universität Berlin (Bachelor's degree program), and in supplementation to the framework study and examination regulations of Freie Universität Berlin (RSPO), requirements and procedures for examination performances (credit points) in the Bachelor's degree program.

§ 2
Qualification objectives:

(1) Graduates of the Bachelor's degree program are aware of the spectrum of essential basic terminology in informatics and methods from theoretical areas in informatics and central concepts of technical and practical informatics, as well as phenomena of socio-technical systems. They can recognize at work where these are relevant and apply them appropriately. They can expand or update this knowledge and these skills independently if necessary and make themselves aware of the state of the art regarding the topic at hand. They are able to precisely specify an informatics-related issue or to approximately model it using appropriate means whilst also being able to express themselves either in a manner that is appropriate for informatics experts or for those within the application at hand. This also covers mathematical modeling of an informatics issue and mastering use of mathematical tools to solve such problems. They can also apply and explain informatics thinking even in non-technical environments. They can construct, implement, document, test, and supply a moderately complex software system on their own or in a team. They use modern work processes, development tools, programming languages, standard system structures, software components, and algorithms appropriately in line with technical and economic aspects. At the same time, they can also take on parts of larger projects in a team in order to independently carry out sub-tasks, recording the results of others and also to pass on their own results. They can convincingly justify the correctness, security, and appropriateness of a solution that they have proposed themselves. They are able to assess the socio-technical effects of computer systems. They develop an individual profile within a compulsory field and become, point-by-point, aware of the current state of research as well as corresponding methods, contents, and applications. They can independently and quickly acquaint themselves with new applications and technologies. They can critically evaluate and act responsibly. With the aid of these fundamentals and techniques, they can analyze and understand new problems in informatics and independently acquire skills that are missing.

(2) Due to these informatics qualifications, graduates have individual knowledge and skills that they have acquired whilst studying an application area from the fields of natural sciences, humanities, economics, law, or the social sciences, as well as in the field of study for general professional skills. Particular importance is given to the ability to adapt to changing fields of activity, to adapt to the changing conditions within the practice of

* This regulation was confirmed by the Executive Board of the Freie Universität Berlin on 12 August 2014

processing information, and also to take an active part in this transformation. Graduates are aware of potential barriers in the use of information-processing systems and know how to design these so they are free of such barriers. They recognize the problems with gender roles and know how to circumvent these, particularly in team projects.

(3) Graduation from a bachelor's degree program means that graduates are qualified for an advanced Master's degree program in informatics or a specialist informatics-related subject. The bachelor's degree program acts as preparation for professional practice within informatics in application, production, research, and teaching-related activities. Graduates find employment in practically all economic sectors as well as in public service. They can work in functions that focus on the design, development, or operation of computer systems, or such functions that otherwise benefit from the versatile informatics approach to thinking complete with modeling, abstraction, systematization, or algorithmization.

§ 3
Study contents

(1) In the Bachelor's degree course software systems and their requirements are analyzed and formalized based on mathematical and informatics theories and methods. Design techniques and creation of new software and hardware systems are learned, and the quality of these is assured using empirical, inductive, and deductive methods. Fundamental methods for programming computers are learned in Algorithms and Programming. The fundamental characteristics of computer systems are examined in technical informatics; students learn how to understand computers as devices with an interface for software development, such as a machine language, an operating system, or a network protocol. The fundamental options and limits of calculating are learned in theoretical informatics as well as techniques for estimating the inherent effort of specific algorithmic processes. Technologies with a view of their use are covered in practical informatics. Fundamental uses of language and methods of formal discourse regarding software are learned and practiced in Mathematics for Informatics, and mathematical processes are transferred in algorithms. Such skills are practiced in teams and based on current technology in the field of study general professional skills. They should learn notions within an application area as well as interpret and use these within the context of informatics.

(2) In discussion with future users, students learn how to establish the requirements of an information system, as well as appropriately present concepts and results within informatics in a manner that the recipient can understand. They learn how to prove formal characteristics and to formulate and present such evidence appropriately. They learn how to formulate empirical properties as a hypothesis and how to argue in defense of such. They learn how to research within informatics and an application area, and can also record written documents as per customs within informatics. To encourage teamwork, exercises and internships are performed in small groups, and self-organized teams perform work in internships and projects. Gender and diversity aspects are taken into account, in as far as is expedient from a scientific perspective, as a requirement of an information system, or within teamwork.

§ 4
Student advisory and course advisory service

The general student advisory service is provided by the Central Student Advisory and Psychological Advisory Office of the Free University of Berlin.

(2) The course advisory service and advice on student progress is provided by professors from the Institute for Informatics in the Faculty of Mathematics and Informatics at Freie Universität Berlin during regular consulting hours.

(3) Every student is assigned to a personal course advisor from the group of professors who are mainly involved in that field. This will be made known in an appropriate manner by the Chairperson of the Examining Board.

(4) Students are recommended that they should visit the student advisory service at least once per year and discuss the level of performance achieved along with planning of the rest of the course.

(5) Advice regarding both parts of the examinations to be completed should be issued by the personal course advisor before completing the modules in the more advanced part and the application part. This should cover the availability of the courses on offer, the modules to be completed, as well as the examinations assigned to the modules and the courses, and a schedule is created. If modules from other universities, departments, or such have to be completed as part of the application part or the advanced part along with access restrictions then permission from the location providing the positions has to be documented.

§ 5
Examining Board

The examining board set up by the Faculty of Mathematics and Informatics at Freie Universität Berlin for the bachelor's degree program is responsible for organizing examinations and for the other tasks stated as part of the RSPO.

§ 6
Standard study period

The standard study period is six semesters.

§ 7
Structure and outline; scope of performance

(1) A total of 180 credit points (CP) must be earned in the Bachelor's degree program. The Bachelor's degree course comprises

1. the informatics part with a scope of 135 CP, consisting of:
   a) a mandatory part with a scope of 108 CP,
   b) the elective part with a scope of 15 CP, and
   c) the Bachelor's thesis along with presentation of the results with a scope of 12 CP,
2. the application area with a scope of 15 CP, and
3. The field of study General Professional Skills (Ger.: ABV) encompassing 30 CP.

(2) The compulsory part of the Informatics division with a scope of 108 CP is divided into the following topics:

1. Subject area: Algorithms and programming with a scope of 35 CP,
   a) The following three modules must be completed:
      – Module: Functional Programming (9 CP),
      – Module: Algorithms, data structures, and data abstraction (9 CP), and
      – Module: Non-sequential and distributed programming (9 CP).
   b) One of the following two modules should be completed as well as an assessment test that should be carried out beforehand in accordance with the result:
      – Module: Object-oriented programming for students with programming knowledge (8 CP) or
      – Module: Object-oriented programming for students without programming knowledge (8 CP).
2. Subject area: Technical informatics, with 10 CP; the following module must be completed:
   – Module: Computer Architecture, Operating and Communication Systems (10 CP).
3. Subject area: Practical informatics, with 22 CP; the following modules must be completed:
   – Module: Effects of informatics (5 CP),
   – Module: Database systems (7 CP), and
   – Module: Software technology (10 CP).
4. Subject area: Theoretical informatics, with 7 CP; the following module must be completed:
   – Module: Fundamentals of Theoretical Computer Science (7 CP).
5. Subject area: Mathematics for informatics, with 29 CP; the following modules must be completed:
   – Module: Logic and Discrete Mathematics (9 CP),
   – Module: Linear algebra for informatics (10 CP), and
   – Module: Analysis for informatics (10 CP).
6. Subject area: Science with 5 CP; the following module must be completed:
   – Module: Scientific work within informatics (5 CP).

(3) Modules with a scope of 15 CP should be completed in the specialist field. In addition, all modules graded separately from the master's degree program in informatics from the Faculty of Mathematics and Informatics of Freie Universität Berlin are possible. Furthermore, the following modules can be chosen and completed:

– Module: Fundamentals of Technical Computer Science (10 CP),
– Module: Research internship (5 CP)
– Module: Basic didactics in informatics (10 CP),
– Module: Scientific work within practical informatics (5 CP),
– Module: Scientific work within theoretical informatics (5 CP),
– Module: Scientific work within technical informatics (5 CP).

(4) Any module from a scientific subject except informatics is an option as a module for the application area with a scope of 15 CP. Separately graded modules with a scope of at least 5 CP should be completed. Modules belonging to the application area to be selected and completed must be from the bachelor's degree program of another subject. The following should be taken into account regarding the available options: The "Linear algebra 1" module from the bachelor's degree program in mathematics offered by the Faculty of Mathematics and Informatics at Freie Universität Berlin can not be done at the same time as the "Linear algebra" module. The "Analysis 1" module from the bachelor's degree program in mathematics offered by the Faculty of Mathematics and Informatics at Freie Universität Berlin can not be done at the same time as the "Analysis" module. The "Algorithmetic bioinformatics" module from the bachelor's degree program in bioinformatics from the Faculty of Mathematics and Informatics at Freie Universität Berlin should be taken in the Bioinformatics application area. The personal course advisor provides students with advice in selecting suitable modules. If modules from other universities, departments, or such have to be completed with access restrictions then permission from the location providing the positions has to be documented.

(5) In the bachelor's degree program modules with a total of 123 to 133 CP in exams graded separately, as well as modules with a total of 35 to 45 CP in exams not graded separately or with no module exam should be selected and completed.

(6) The module descriptions in Annex 1 provide information for the modules in the module offerings regarding admission requirements, contents and qualification objectives, forms of teaching and learning, time requirements, forms of active participation, examination work required alongside studies, obligations regarding regular participation in the forms of teaching and learning, credit points assigned to the relevant modules, normal duration, and frequency of offering.

For the Master's degree program in informatics, reference is made to the Study and Examination Regulations for the Master's degree program in Informatics of the Faculty of Mathematics and Informatics of Freie Universität Berlin. For the modules "Linear Algebra 1" and "Analysis 1", reference is made to the Study and Examination Regulations for the Bachelor's Degree Course in Mathematics of the Faculty of Mathematics and Informatics of Freie Universität Berlin. Reference is made to the relevant Study and Examination Regulations of the corresponding bachelor's degree program for the modules in the application area.

(8) The examples of courses of study in Annex 2 provide information on the recommended study sequence.

§ 8
Forms of teaching and learning

The following forms of teaching and learning are offered at Freie Universität Berlin as part of courses on offer:

1. Lecture (L): The instructor presents the material in the lecture and explains it. The students deepen their knowledge of the material through regular preparation and follow-up.
2. Exercise (E): Exercises take place in small groups as an accompaniment to lectures, where these groups should not contain more than twenty participants. The exercises are carried out by student assistants, or research assistants under the supervision of the instructor for the relevant lecture. Exercise sheets with tasks appear at regular intervals regarding a lecture, and these should be done by students independently as homework or in small groups that are organized by the students themselves. The solutions, or approaches to solving the problems, are stated in workgroups and then discussed. The purpose of workgroups is to deepen knowledge of the material covered in the lecture, as well as learning and practicing methods and techniques. In addition, the discussion should cover informatics, collaboration, and planning own work processes.
3. Internship (I): Internships are used on the basis of several practical tasks to develop skills and to successfully use problem solving methods within informatics. This includes specification of problems and breaking it down into subproblems. Solutions and results should be regularly prepared, demonstrated, worked out in writing, and presented. The purpose of internships is to have a secure grasp of acquired knowledge and the skills that are practiced.
4. Proseminar (PS): A specific topic within informatics, or applications within informatics is covered together by the students and the instructor in a proseminar. Every student, with assistance from the instructor, is largely responsible for preparing a presentation that is prepared in writing and then presented and discussed during the proseminar. As every presentation with subsequent discussion takes at least 45 minutes, proseminars should consist of 15 to a maximum of 30 students. The purpose of a proseminar is to learn how to carry out thorough academic work under instruction, how to write a scientific piece of work as preparation for the bachelor's thesis, and also to gain communication and rhetorical skills.
5. Seminar (S): A seminar is used to impart knowledge of a distinct subject area and to acquire skills, independently answer a question, illustrate the results and to discuss these critically. The major lesson types are seminar discussions based on teaching materials, on lectures that are to be prepared (specialist literature and sources), on assignments, as well as group work.
6. Advanced seminar (AS): A specific topic area is explored between the participants and the lecturer in an advanced seminar. Every student also is largely responsible for preparing a presentation that is prepared in writing and then presented and discussed during the advanced seminar. As every presentation usually takes up an hour or so, advanced seminars should be for up to fifteen participants. The purpose of an advanced seminar is the intensive focus on illustrative topics and more in-depth independent academic work, as well as the continued development of communication and rhetorical skills.
7. Practical seminar (PrS): It is used for the application of teaching and learned content as well as the work methods of an academic discipline within a practical project. The major type of work is supervised performance of a project accompanied in practical fields.
8. Project seminar (PrjS): This is used to deepen scientific knowledge and improve awareness of methodology in applications and problems. The project groups are small groups which are independently organized by students and supervised by lecturers who help support work carried out on the project.
9. Seminar on PC (SPC) During on-campus time these are used to impart knowledge of a distinct subject area and to acquire skills, independently answer a question, illustrate the results and to discuss these critically. The major type of work is working together on a PC whilst using special software.
10. Tuition in seminars (TiS): Tuition in seminars means application-oriented knowledge and skills are independently acquired, introduced, and discussed within the group.
12. During the occupational internship within the field of study ABV, students gain insight into the application of acquired scientific knowledge and methods under supervision whilst testing out their suitability for specific jobs.

(2) The forms of teaching and learning in line with Par. 1 can be used in blended learning arrangements. The on-campus studies are linked with electronic media such as Internet-based media (e-learning). In this case, selected teaching and learning activities are offered via e-learning formats and either carried out by students independently on their own or in a group, and/or with other support.

§ 9
Field of study general professional skills

(1) In the field of study general professional skills (ABV), students supplement their specialist scientific studies with broader, general scientific content and acquisition of additional professional competencies to prepare them to assume positions after their studies that are adequate in terms of their qualification and may also be in an international setting.

(2) The modules of the field of study ABV are also

described in the Study Regulations and Examination Regulations for the Field of Study General Professional Skills in Bachelor's Degree Courses at the Freie Universität Berlin (StO-ABV and PO-ABV) or in these study and examination regulations.

(3) The field of study ABV encompassing 30 CP includes a mandatory professional internship encompassing 10 CP as well as different areas of competence covering professionally relevant subject matter. The following modules should be selected and completed as part of the field of study:

1. Competence area Subject-Related Additional Qualifications:
   a) In addition, one of the following two mandatory modules should be chosen and completed:
      – Module: Software project A (10 CP), or
      – Module: Software project B (10 CP).
   b) Freely selectable modules from the following options with a scope of 5 or 10 CP:
      – Module: Methodology of work and life (5 CP),
      – Module: Start-up in the IT industry (5 CP),
      – Module: Social aspects of Practical Computer Science (5 CP),
      – Module: Legal aspects of Practical Computer Science (5 CP),
      – Module: Planning, performing, and analysis of an informatics tutorial (5 CP),
      – Module: Foundations of managing IT projects (5 CP),
      – Module: System management (5 CP).

Furthermore, as part of the competence area in subject-related additional qualifications, as per no. 1 letter b) the computer algebra (5 CP), statistics software (5 CP), introduction to visualization (5 CP), and planning, performing, and analysis of a tutorial (5 CP) modules in the ABV field of study within the mathematics bachelor's degree program from the Faculty of Mathematics and Informatics at Freie Universität Berlin can all be chosen; reference is made to the corresponding Study and Examination Regulations.

2. Freely selectable modules in other competence areas with a scope of 5 or 10 CP.
3. Occupational internship: The "Occupational informatics internship" (10 CP) module should be completed.

The "Occupational informatics internship" module to be completed as part of the field of study ABV aims to provide students with an insight into possible jobs and professions and confront them with requirements in the real world. It tests acquired knowledge and therefore has an orientation function for an objective-oriented direction of the course with regard to professional qualifications. The internship advisor in the Faculty of Mathematics and Informatics appointed by the Department Council is responsible for providing advice regarding general conditions of the occupational internship and support in searching for such an internship.

(5) The modules as per Par. 3 as well as credit points earned therein must not coincide with modules and credit points of the Informatics part and the application part.

§ 10
Bachelor's Thesis

(1) The Bachelor's thesis should demonstrate that the student is in a position to work independently on a practically or theoretically designed task from a topic area in Computer Science using scientific methods, and to present the results in writing and orally in an appropriate manner.

(2) Students will be admitted to work on a Bachelor's thesis upon application if they can prove at the time of application that they

1. in the first instance have been enrolled at Freie Universität Berlin and
2. That they have successfully completed modules totaling at least 90 credit points, including the following modules:
   – Module: Algorithms, Data Structures and Data Abstraction (9 credit points),
   – Module: Fundamentals of Theoretical Computer Science (7 credit points),
   – Module: Logic and Discrete Mathematics (9 credit points),
   – Module: Linear Algebra (10 credit points), or Linear Algebra 1 (10 credit points),
   – Module: Computer architecture, Operating Systems and Networks (10 credit points) and
   – Module: Scientific Work in Computer Science (5 credit points).

(3) The application for admission of the Bachelor's thesis is to be accompanied by evidence of the prerequisites in accordance with paragraph 2, as well as confirmation from an authorized teacher that he or she is willing and able to act as supervisor for the Bachelor's thesis. The competent Examination Committee decides on the application. If a statement of acceptance for the supervision of the Bachelor's thesis is not submitted in accordance with sentence 1, the examining board will appoint a supervisor.

(4) The examining board, in consultation with the supervisor, assigns the topic of the Bachelor's thesis. The theme and set tasks must be of such a nature that the work can be completed within the assigned period. The task and compliance to deadlines are to be documented.

(5) The work may also be carried out externally at a suitable company or at a scientific institution, provided that scientific supervision is guaranteed in accordance with paragraph 3.

(6) The written component of the Bachelor's thesis should be 7,500 words long, approximately 25 sides in length. The time to be spent on the Bachelor's thesis amounts to 12 weeks. It may be written in either German or English. If the examining board gives its approval, other language are also permissible. If a student has been prevented from working on the thesis for a period of more than four weeks for a valid reason, the examining board will decide whether the Bachelor's

thesis must be begun afresh. Examination performance with regard to the Bachelor's thesis will be deemed not to have been undertaken in cases when the examining board has decided upon a further attempt.

(7) The date set for the start of work on the topic is determined by the examining board. The topic can be returned within the first four weeks, and in those cases it will not be considered as issued. Upon submission, the student must provide written confirmation that he or she has composed the Bachelor's thesis without assistance and has used no other sources or resources apart from those cited and acknowledged. The written component of the Bachelor's thesis is to be submitted typewritten as three bound copies and as an electronic version in accordance with §14.

(8) The written component of the Bachelor's thesis shall be evaluated in a written statement within four weeks by two examiners appointed by the examining board. The supervisor of the Bachelor's thesis should be one of the examiners. At least one of the two evaluations should be written by a professor who is employed at the Institute of Computer Science at the Department of Mathematics and Computer Science at Freie Universität Berlin.

(9) The written component of the Bachelor's thesis will be considered to have passed if the mark attained for the work is at least "sufficient" (4.0). The grade for the written component of the Bachelor's thesis is calculated as being the arithmetic mean of the two grades given by the two examiners. If one or more of the examiners evaluates the work as "non sufficient" (5.0) or if the two individual grades given by the examiners are 2.0 or more apart, the examining board will task a third examiner to evaluate the written component of the Bachelor's thesis. In this case, the grade for the written component of the Bachelor's thesis will be calculated as the arithmetic mean of the marks given by the three examiners.

(10) The results of the Bachelor's thesis are to be given as part of a presentation, scientifically classified (approx. 15 minutes) and defended (approx. 15 minutes) The prerequisite for giving a presentation is the submission of the Bachelor's thesis. The oral presentation is to take place as soon as possible after the Bachelor's thesis has been submitted. The appointment is announced well ahead of time in an appropriate form. The lecture and discussion are open to the faculty.

(11) The oral component of the Bachelor's thesis will be conducted by two appointed examiners. They should be identical to the examiners who evaluated the Bachelor's thesis. The grade for the oral component of the Bachelor's thesis is calculated as being the arithmetic mean of the two individual grades.

(12) The grade for the oral component of the Bachelor's thesis will make up one sixth of the combined grade for the Bachelor's thesis, while the grade for the written component of the Bachelor's thesis will make up five sixths of the grade.

(13) The Bachelor's thesis will be considered to have passed if the combined grade attained for the Bachelor's thesis is at least "sufficient" (4.0).

(14) The examining board can, upon request, count as credit a successfully completed Bachelor's thesis from another institution of higher education or in another subject in cases when the qualification is equivalent. The application must be accompanied by a bound copy of the Bachelor's thesis and a copy in electronic format, as well as proof that the Bachelor's thesis has been assessed and evaluated.

§ 11
Repetition of examinations

(1) Examination work can be repeated three times, and the Bachelor's thesis can be repeated once if these are not originally passed.

(2) If the first potential examination date is directly after the end of the associated course then an examination performance graded as "sufficient" (4.0) or better in the module may be repeated once for the purpose of improving a grade, which takes place by the beginning of the subsequent semester at the very latest. The better grade will be taken into account. An improvement in the grade is not possible in case of a repeated exam.

§ 12
Electronic examinations

(1) In the case of electronic examinations, performance and evaluation is carried out with digital technologies.

(2) Before an examination where digital technologies are used, the suitability of such technologies with regard to the intended examination tasks, and performance of the electronic examination, should be verified beforehand by two examiners.

(3) The authenticity of the author and the integrity of examination results should be safeguarded. The examination results, in the form of electronic data, are clearly identified to this effect and also unmistakably and permanently assigned to the student. It should be ensured that electronic data remains unchanged and complete for assessment and for verifiability.

(4) An automatically generated assessment of examination performance should be checked by an examiner if requested by the student in question.

§ 13
Multiple choice test

(1) Examination tasks in the form of a multiple choice test should be carried out by two examiners.

(2) If, during assessment of examination performances in multiple choice tests, a noticeable concentration of errors can be seen in answering individual questions, then an examiner immediately forwards all examination documentation to the Examining Board before the examination results are published. The Examining Board checks the examination tasks to ensure that they are set for the

qualification objectives of the relevant module and provide reliable examination results. If the review establishes that individual examination tasks are flawed then these should not be taken into account when determining the results. The number of examination tasks to be taken into account when determining the examination result is correspondingly lowered. Reducing the number of examination tasks must not be to the detriment of a student. If the proportion of evaluation points of the examination tasks to be removed exceeds 10 percent of the achievable points total in the multiple choice test then the examination must be repeated.

(3) An examination in the form of a multiple choice test has been passed if the student has achieved at least 50 percent of the achievable total of points (absolute pass limit) or if the number of points achieved by the student is not more than 10 percent lower than what participants in the examination have achieved on average (relative pass limit).

(4) Examinations in the form of a multiple choice test should be assessed as follows:

If the student has achieved the minimum point score required to pass the examination as per para. 3, then the grade is

– very good, if he or she achieves at least 75 percent,
– good, if he or she achieves at least 50 but less than 75 percent,
– satisfactory, if he or she achieves at least 25 but less than 50 percent,
– adequate, if he or she achieves zero but less than 25 percent

of the minimum point score set out in para. 3; the RSPO also applies for the grades that are to be used.

§ 14
Submission format of written examination work

Written examination work that is not in the form of a written exam should also be submitted in electronic form in portable document format (PDF). The files in PDF format should have machine-readable text and not just contain charts; furthermore there should be no rights restrictions. Systems such as computer programs and measurement data should be submitted in a machine-readable format; in the case of computer programs, the complete source text should be submitted.

§ 15
Studies abroad

(1) It is recommended that students participate in studies abroad. The study abroad is a rewarding opportunity to enhance skills gained during study in both academic terms as well as in cultural and personal terms. Within the framework of study abroad, credit points are acquired that count towards the Bachelor's degree program and supplementary fields of study. This cannot count towards the bachelor's thesis.

(2) Before the study abroad takes place, it should be preceded by conclusion of an agreement between the student, the representative for scholarship programs and foreign studies within the Faculty with collaboration from the chairperson of the examining board and also of the relevant body at the target university regarding the duration of the period of studies abroad, the scope of performances expected during the studies abroad, which are to be equivalent to the performance items in the Bachelor's Program, and the credit points to be assigned to these performance items. Performance items or equivalent completed as per the agreement are then credited accordingly.

(3) Study abroad can take place at any higher education institution abroad. Study abroad can also be combined with other programs or carried out on own initiative alongside the worldwide direct exchange program from Freie Universität Berlin. The advisor for studies abroad in the Faculty of Mathematics and Informatics at Freie Universität Berlin will provide information for all students who are interested in studying abroad.

(4) In a Bachelor's degree program, the 5th subject-specific semester is particularly expedient for studies abroad. It is also possible to complete the "occupational internship" module during a stay abroad. The internship advisor and the careers service at Freie Universität Berlin provide advice.

§ 16
Graduation

(1) The graduation requirement for the Bachelor's degree program is that the scope of study performance as required by §§ 7 and 10 of these regulations has been completed.

(2) Graduation is not permitted if the student has conclusively failed to complete a required scope of performance or conclusively failed to pass required examinations or is involved in a pending examination procedure at a university in the same course of studies, or in a module that is identical or comparable to a module completion of which is required for the Bachelor's Program and the grade for which counts towards the overall grade.

(3) The application for recognition of graduation must be accompanied by proof of satisfaction of the requirements as per Par. 1 and a statement confirming that none of the cases under Par. 2 applies to the person of the applicant. The competent Examination Committee decides on the application.

(4) The university degree Bachelor of Science (B. Sc.) is awarded upon passing the examination. Students receive a Report of Grades and a Diploma (Annexes 2 and 3) as well as a Diploma Supplement (in English and German). A further supplement to the Report of Grades is also issued that contains information on the individual modules and their content (Transcript). An English translation of the Report of Grades and Diploma are also issued on request.

§ 17
Entry into force and transitional regulation

(1) These regulations come into form on the day following their publication in the Official Gazette of the

Free University of Berlin (FU Announcements).

(2) At the same time, the study regulations for the Bachelor's degree program as of November 15 2006 (Freie Universität Official Announcements 6/2007, p. 54) and the Examination regulations as of November 15 2006 (Freie Universität Official Announcements 6/2007, p. 83) are now invalid.

(3) These regulations apply to students who matriculate following their entry into force for the Bachelor's Program at the Free University of Berlin. Students who matriculated for the bachelor's degree program at the Free University of Berlin before entry into force of these regulations study and complete their course work based on the Study and Examination Regulations as per Par. 2 unless they apply to the Examination Committee to continue the degree program and complete their course work based on the present regulations. In the latter case, on the occasion of the transcription resulting from said application, the Examination Committee shall make a decision regarding the scope of modules begun or completed when the application was made or regarding crediting of these performance items within the framework of these regulations, whereby the principles of legitimate expectation and equal opportunity are respected. The decision regarding the transfer application will become effective at the beginning of the lecture period of the relevant semester. The transcription cannot be revised.

(4) The opportunity to complete the course of studies according to the Study and Examination Regulations as per Par. 2 is to be upheld until the end of the 2017 summer semester.

Annex 1: Module descriptions

Explanations:

The following module descriptions refer to every module of the Bachelor's degree course unless reference is made to other regulations

- the designation of the module,
- those who are responsible for the module,
- requirements for admission to each module,
- content and qualification objectives of module,
- teaching and learning forms of module
- estimated student effort requirement to complete the module,
- forms of active participation,
- examination forms,
- mandatory regular participation,
- the credit points assigned to the modules
- normal duration of module,
- frequency of course offering,
- applicability of the module

The information on time requirements refer in particular to

- active participation in on-campus study period,
- time required for completion of minor tasks related to on-campus study period,
- time for independent preparation and follow-up,
- processing of study units in online study phases,
- preparation time immediately prior to examinations,
- examination time.

The information on time requirements for self-study (including preparation and follow-up, examination preparations, etc.) are guideline values to help students organize the time required for module-related work. The information on work effort requirements corresponds to the number of credit points assigned to each module as the unit of measure for student work effort as an approximation of the work required to complete the module successfully. A credit point is equivalent to 30 hours.

To the extent the required study performance includes regular participation, this is established, as well as active participation in the teaching and learning forms and successful completion of the examination requirements of each module, as a precondition for acquiring the credit points assigned to the respective module. Regular participation compliance is when at least 85 per cent of the on-campus study time scheduled in the teaching and learning forms of a module were attended. Even if there is no mandatory regular participation in a type of learning for a module, it is strongly recommended nonetheless. The relevant instructor cannot establish compulsory presence for types of learning for where participation is merely recommended.

Module exams - if assigned - must be taken for each module. Graded modules are completed with only one examination (module exam). The module exam must reflect the qualification objectives of the module. It tests whether the objectives of the module have been reached based on an exemplary sampling. The scope of the examination is limited to what is required to achieve this. In modules for which alternative examination forms are planned, the examination form for each semester must be determined by the responsible instructor by the first course date at the latest.

Active and - if provided - regular participation in the teaching and learning forms as well as successful completion of the examination requirements of each module, are the preconditions for acquiring the credit points assigned to each module. In modules with no module examination, active participation as well as regular participation in the teaching and learning forms are the preconditions for acquiring the credit points assigned to each module.

I. Mandatory part:

1. Subject area - algorithms and programming

<table>
<tr><td colspan="4">Module: Functional Programming</td></tr>
<tr><td colspan="4">University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics</td></tr>
<tr><td colspan="4">Persons responsible for module: Lecturer for the module</td></tr>
<tr><td colspan="4">Admission requirements: None</td></tr>
<tr><td colspan="4">Qualification objectives:
Students are aware of the basic terminology for algorithms and for functional programming. At the end of the module they can read descriptions and source texts of elementary algorithms, functionally design elementary algorithms, specify requirements of functional programs, understand descriptions of program components and use these in their own programs, adapt simple programs to amended requirements, develop structured programs, formally prove features of functional programs. They understand the terms runtime and correctness and can use these terms accurately. They have a fundamental understanding of predictability.</td></tr>
<tr><td colspan="4">Contents:
Students learn the fundamentals of programming on a small scale. The fundamentals of predictability (Lambda calculus, primitive recursive function, benchmarks), an introduction into the theory of programming languages (syntax [Backus-Naur form], operational semantics, data, and program) are also covered. Concepts of functional programming (e.g. elementary data types, expressions, functional definition, recursion, functional abstraction, closure, higher-order functions, universal polymorphism) and execution thereof (evaluation strategies) are covered. Techniques for proving program features (term-rewriting, structural induction, scheduling, Church-Rosser theorem) and their applications (type systems, type derivation, and type checking) are covered. Fundamental abstractions such as algebraic and abstract data types, and modular program design as well as secondary effects (e.g. via monads) based on inputs and outputs are covered.</td></tr>
<tr><td>Forms of teaching and learning</td><td>On-campus studies
(hours per semester week = SWH)</td><td>Forms of active participation</td><td>Work effort
(hours)</td></tr>
<tr><td>Lecture</td><td>4</td><td rowspan="2">Written work on assigned exercise sheets
Oral presentation of assigned exercises</td><td rowspan="2">On-campus time L 60
Preparation and follow-up L 30
On-campus time SPC 30
Preparation and follow-up SPC 120
Examination preparation and examination 30</td></tr>
<tr><td>Seminar on PC</td><td>2</td></tr>
<tr><td colspan="2">Module exam:</td><td colspan="2">Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).</td></tr>
<tr><td colspan="2">Course language:</td><td colspan="2">German</td></tr>
<tr><td colspan="2">Mandatory regular participation:</td><td colspan="2">Lecture: Participation recommended, seminar on PC: Yes</td></tr>
<tr><td colspan="2">Total working time requirement:</td><td>270 hours</td><td>9 CP</td></tr>
<tr><td colspan="2">Duration of module:</td><td colspan="2">One semester</td></tr>
<tr><td colspan="2">Frequency of course offering:</td><td colspan="2">Each winter semester</td></tr>
<tr><td colspan="2">Applicability:</td><td colspan="2">Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training</td></tr>
</table>

Module: Object-oriented programming for students with programming knowledge

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students master imperative and object-oriented programming concepts and their applicability, and can create object-oriented models. They are aware of fundamental data structures and algorithms, and are able to specify and implement abstract data types. They are aware of fundamental data structures and algorithms, and can formally and informally prove the properties of small programs. They can implement object-oriented programs and use design patterns that are appropriate for the problem.

Contents:

This module is aimed at students, whose assessment test demonstrated prior knowledge in an object-oriented programming language.

The following themes are covered:

- Mechanical modeling of the predictability term (register machines) and central imperative programming concepts.
- Evidence of features of small programs (Hoare logic and/or predicate transformer semantics).
- Object-oriented programming concepts (such as classes, objects, references, methods, inheritance, polymorphic type systems, abstract classes, interfaces, generic class definitions, encapsulation, error handling, etc.).
- Simple data structures and implementation thereof whilst using object-oriented programming techniques as well as fundamental concepts of data abstraction.
- Advanced object-oriented modeling techniques and fundamental design patterns (iterators, observer patterns, structural patterns, MVC etc.)
- Realization/implementation of concepts is introduced based on modern, currently used, object-oriented programming languages.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	3	Assessment test, implementation of a small application, production and introduction of solutions of at least 85 % of tasks	On-campus time L	45
			Preparation and follow-up L	30
			On-campus time SPC	30
Seminar on PC	2		Preparation and follow-up SPC	105
			Examination preparation and examination	30
Module exam:		Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).		
Course language:		German		
Mandatory regular participation:		Lecture: Participation recommended, seminar on PC: Yes		
Total working time requirement:		240 hours	8 CP	
Duration of module:		One semester		
Frequency of course offering:		Each summer semester		
Applicability:		Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training		

Module: Object-oriented programming for students without programming knowledge

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students master imperative and object-oriented programming concepts and their applicability, one or more object-oriented programming languages, and can create object-oriented models. They are aware of fundamental data structures and algorithms, and are able to specify and implement abstract data types. They are aware of fundamental data structures and algorithms, and can formally and informally prove the properties of small programs.

Contents:

This module is aimed at students, whose assessment test demonstrated little knowledge in an object-oriented programming language. This knowledge is imparted in a concentrated format in the introduction course and basic skills in programming are also learned.

The following themes are covered:

- Mechanical modeling of the predictability term (register machines) and central imperative programming concepts.
- Evidence of features of small programs (Hoare logic and/or predicate transformer semantics).
- Object-oriented programming concepts (such as classes, objects, references, methods, inheritance, polymorphic type systems, abstract classes, interfaces, generic class definitions, encapsulation, error handling, etc.).
- Simple data structures and implementation thereof whilst using object-oriented programming techniques as well as fundamental concepts of data abstraction.
- Advanced object-oriented modeling techniques and fundamental design patterns (iterators, observer patterns, structural patterns, MVC etc.)
- Realization/implementation of concepts is introduced based on modern, currently used, object-oriented programming languages.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Induction course	1	Assessment test, production and introduction of solutions of at least 85 % of tasks	Induction course	15
			On-campus time L	45
Lecture	3		Preparation and follow-up L	30
			On-campus time SPC	30
			Preparation and follow-up SPC	90
Seminar on PC	2		Examination preparation and examination	30

Module exam:	Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, seminar on PC: Yes	
Total working time requirement:	240 hours	8 CP
Duration of module:	One semester	
Frequency of course offering:	Each summer semester	
Applicability:	Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training	

Module: Algorithms, data structures, and data abstraction

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students can define the basic terminology within algorithmics. They know what an abstract data type is, and understand the difference between specification and implementation. They know the most important abstract data types and the data structures regarding their implementation, can evaluate these with regard to their features, as well as select and use them appropriately. They can demonstrate the correctness of algorithms and determine the asymptotic run time of algorithms. They know the definition and understand the practical meaning of NP-completeness for efficient solvability of problems.

Contents:

Fundamental data structures such as lists, queues, cellars, trees, sorting procedures (mergesort, quicksort, amongst others), search procedures, selection procedures; abstract data types, priority queues and dictionary and associated data structures such as heaps, hash tables, binary search trees, b-trees amongst others; algorithms on graphs such as a breadth-first or depth-first search, topological sorting, shortest spanning trees, shortest routes; algorithms for character strings; memory management; general solutions such as divide and rule, dynamic programming, select and dispose, greedy algorithms. Mathematical analysis of algorithms regarding run time and memory. NP-completeness.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Written work on assigned exercise sheets, two oral presentations regarding the solution to a task in the exercise	On-campus time L	60
			Preparation and follow-up L	30
			On-campus time E	30
Exercise	2		Preparation and follow-up E	120
			Examination preparation and examination	30

Module exam:	Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, exercise: Yes	
Total working time requirement:	270 hours	9 CP
Duration of module:	One semester	
Frequency of course offering:	Each winter semester	
Applicability:	Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training	

Module: Non-sequential and distributed programming

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: Successful competition of the object-oriented programming module for students without programming knowledge or the object-oriented programming module for students with programming knowledge

Qualification objectives:

Students understand the basic terms of non-sequential and distributed programming with a joint memory that interact with each other. They can appropriately structure distributed programs with processes/threads/active objects and also avoid unwanted non-deterministic effects and deadlocks via suitable synchronization processes. They are aware of and understand security risks that may occur in non-sequential programming and can use methods to avoid these. They can formally specify the features of processes and threads and verify these using examples.

Students can distinguish between relevant interaction paradigms such as client/server and peer-to-peer, and classify own applications appropriately in line with these paradigms, and construct distributed systems based on inter-process communication and remote calls. They can appropriately design, structure, and realize web applications, client/service provider applications, and peer-to-peer applications, and develop distributed systems with the aid of suitable middleware.

Contents:

Programming and synchronization of simultaneously running processes that access the same memory or interact with each other.

– Non-sequential programming and processes in its various formats, non-determinism, determinism
– Synchronization mechanisms: Locks, monitors, guards, events, semaphores
– Non-sequential programming and object orientation
  Sequence control, selection strategies, priorities, handling and avoiding deadlocks
– Coroutines, implementation, multi-processor systems
– Interaction via messages, security aspects of applications in the network
– Programming and synchronization of simultaneously running processes that interact with each other.
– Remote call technologies
– Client-server, peer-to-peer
– Parallel computing within the network
– Coordination languages, orchestration, choreography
– Processing on the server and the client, mobility
– Middleware, structured communication, static and dynamic interfaces
– Event-based and stream-based processing
– Security of applications in network, securing protocols
– Outlook on non-functional features (time, memory, quality of service)

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Written work on assigned exercise sheets Oral presentation of solutions to assigned exercises within exercises	On-campus time L	60
			Preparation and follow-up L	30
			On-campus time E	30
Exercise	2		Preparation and follow-up E	120
			Examination preparation and examination	30

Module exam:	Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, exercise: Yes	
Total working time requirement:	270 hours	9 CP
Duration of module:	One semester	
Frequency of course offering:	Each summer semester	
Applicability:	Bachelor's degree program in Informatics	

2. Subject area - Technical computer science

<table>
<tr><td colspan="4">Module: Computer Architecture, Operating and Communication Systems</td></tr>
<tr><td colspan="4">University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics</td></tr>
<tr><td colspan="4">Persons responsible for module: Lecturer for the module</td></tr>
<tr><td colspan="4">Admission requirements: None</td></tr>
<tr><td colspan="4">Qualification objectives:

At the end of the module, students understand fundamental architectural features of computer systems, interactions of architectural features in multi-core and multi-processor systems, elementary options for speeding up computer systems, the role of the operating system as an abstraction of the computer system, the fundamental construction of current operating systems, the function and construction of the Internet. They can program computers at an assembler level and are very close to the system, they can assess the benefits and drawbacks of various mechanisms (PIO vs. DMA, polling vs. interrupt, paging vs. segmentation, etc.), expediently use mechanisms of operating systems, can allow programs to communicate via the network. Input/output systems, DMA/PIO, interrupt handling, buffers, processes/threads, virtual storage, UNIX and Windows, shells, utilities, peripherals and networking, networks, media, media access, protocols, reference models TCP/IP, fundamental structure of the Internet.</td></tr>
<tr><td colspan="4">Contents:

In particular, topics include Harvard/von Neumann architecture, RISC/CISC micro-architecture, micro-programming, pipelining, caches, storage hierarchy, bus systems, assembler programming, multi-processor systems, VLIW, and branch predictors. At the same time, internal number representation, computer arithmetic, and representation of other data types in the computer are covered.
In particular, topics include input/output systems, DMA/PIO, interrupt handling, buffers, processes/threads, virtual storage, UNIX and Windows, shells, utilities, peripherals and networking, networks, media, media access, protocols, reference models TCP/IP, fundamental structure of the Internet.</td></tr>
<tr><td>Forms of teaching and learning</td><td>On-campus studies
(hours per semester week = SWH)</td><td>Forms of active participation</td><td>Work effort
(hours)</td></tr>
<tr><td>Lecture on computer architecture</td><td>2</td><td rowspan="4">Written work on assigned exercise sheets
Oral presentation of solutions to assigned exercises within exercises</td><td rowspan="4">On-campus time L CA 30
Preparation and follow-up L CA 30
On-campus time SPC on CA 30
Preparation and follow-up SPC on CA45
On-campus time L OCS 30
Preparation and follow-up L OCS 30
On-campus time SPC on OCS 30
Preparation and follow-up SPC on OCS 45
Examination preparation and examination 30</td></tr>
<tr><td>Seminar on PC regarding computer architecture</td><td>2</td></tr>
<tr><td>Lecture on operating and communication systems</td><td>2</td></tr>
<tr><td>Seminar on PC regarding operating and communication systems</td><td>2</td></tr>
<tr><td colspan="2">Module exam:</td><td colspan="2">Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).</td></tr>
<tr><td colspan="2">Course language:</td><td colspan="2">German</td></tr>
<tr><td colspan="2">Mandatory regular participation:</td><td colspan="2">Lecture: Participation recommended, seminar on PC: Yes</td></tr>
<tr><td colspan="2">Total working time requirement:</td><td>300 hours</td><td>10 CP</td></tr>
<tr><td colspan="2">Duration of module:</td><td colspan="2">Two semesters</td></tr>
<tr><td colspan="2">Frequency of course offering:</td><td colspan="2">Each semester</td></tr>
<tr><td colspan="2">Applicability:</td><td colspan="2">Bachelor’s degree program in Informatics</td></tr>
</table>

3. Subject area - Practical computer science

Module: Effects of informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students

– understand the difference between stock knowledge and orientated knowledge,

– learn how to distinguish between technical questions, technological assessment, and technological impact assessment when thinking about informatics systems,

– understand the responsibility aspects of engineering activities,

– learn several aspects of technological assessment in specific informatics-related fields such as security, protection of privacy,

– understand gender and diversity aspects of applications and in application development.

Contents:

This module covers the effects of informatics. After fundamental questions (concept, stock knowledge, concept of responsibility, subjectivity of technological sociology) the consequences of technology in sustainable informatics areas are specifically covered with examples, e.g. the security of software-intensive technical systems, protection of the private sphere, or the effects of computerization of the working environment.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2	Participation in discussions in the seminar, presentation of own research findings	On-campus time L	30
			Preparation and follow-up L	45
Seminar	2		On-campus time S	30
			Preparation and follow-up S	45

Module exam:	None	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, exercise: Yes	
Total working time requirement:	150 hours	5 CP
Duration of module:	One semester	
Frequency of course offering:	Each winter semester	
Applicability:	Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training	

Module: Database systems

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students will be able to explain the structure of a database, explain the processing of commands at the database, create database models (such as ER models) from application descriptions, derive a relational model from a database schema, create a database based on a relational model, formalize an inquiry in relational algebra, create inquiries regarding data analysis and carry these out on a database, create inquiries regarding a database and schema manipulation and carry these out on the database. They can explain the motivation for normalizing data and can apply algorithms for normalizing data. They can explain alternative memory structures and compare these semantically. They can implement applications with access to a database. They can schematically illustrate and explain methods for accelerating database inquiries as well as implement with suitable data structures. They can explain and apply the main methods of transaction management on databases, and can apply the principles of simultaneous access to databases. They can explain and implement methods of data recovery. They can understand and apply fundamental methods of data mining. They can understand, explain, and apply trends in the area of database systems.

Contents:

Database design with entity-relationship models and UML; theoretical basics of relational database systems, relational algebra; functional dependencies, normal forms, relational database development: Data definition, foreign keys, other integrity conditions, object-relational mapping, security and protection concepts; transaction concept, transactional guarantees, synchronization of multi-user mode, fault tolerance features.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	3	Written work on assigned exercise sheets Oral presentation of solutions to assigned exercises within exercises	On-campus time L	45
			Preparation and follow-up L	45
			On-campus time E	15
Exercise	2		Supervised in PC lab	15
			Preparation and follow-up E	60
			Examination preparation and examination	30

Module exam:	Oral exam (approx. 20 minutes) or written exam (90 minutes), the written exam can also be carried out in the form of an electronic examination (90 minutes).	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, exercise: Yes	
Total working time requirement:	210 hours	7 CP
Duration of module:	One semester	
Frequency of course offering:	Each summer semester	
Applicability:	Bachelor's degree course in informatics, bachelor's degree course Informatics for Teacher Training, Bachelor's degree course in Bioinformatics	

Module: Software technology

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students understand the essential questions for the development of larger systems; they understand the major different framework conditions within which this development can take place; they understand the most important approaches via which these questions can be resolved, and can analyze their features; they can evaluate under which conditions which approaches may be successful; they can carry out the most important approaches independently; they master the methods behind project management, and they can also take gender and diversity aspects into account in project management.

Contents:

Principles, methods, and techniques for developing programming systems are covered in the lecture, as well as an introduction to project management. Important individual skills are specifically tested in the accompanying exercise. Amongst other things, participants learn answers to the following questions:

– How do you find out what features software should have? (Defining requirements)

– How are these features described? (Describing requirements)

– What makes good software? (Quality features)

– How is software structured such that it can be easily built and flexibly changed? (Architecture, Design)

– How are faults discovered in software? (Analytical quality assurance)

– How are faults prevented? (Constructive quality assurance)

– How is the work organized in a software department or a software project in order to regularly get cost-effective, high-quality results? (Project management, Process management, Organization)

Students are recommend to complete the “Software technology” module and the software project/professional internship in the same semester.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Participation in discussions in the exercise, presentation of own research findings	On-campus time L	60
			Preparation and follow-up L	60
			On-campus time E	30
Exercise	2		Preparation and follow-up E	90
			Examination preparation and examination	60
Module exam:		Oral exam (approx. 20 minutes) or written exam (90 minutes), the written exam can also be carried out in the form of an electronic examination (90 minutes).		
Course language:		German		
Mandatory regular participation:		Lecture: Participation recommended, exercise: Yes		
Total working time requirement:		300 hours	10 CP	
Duration of module:		One semester		
Frequency of course offering:		Each summer semester		
Applicability:		Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training		

4. Subject area - Theoretical computer science

<table>
<tr><td colspan="4">Module: Fundamentals of Theoretical Computer Science</td></tr>
<tr><td colspan="4">University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics</td></tr>
<tr><td colspan="4">Persons responsible for module: Lecturer for the module</td></tr>
<tr><td colspan="4">Admission requirements: None</td></tr>
<tr><td colspan="4">Qualification objectives:
Upon successful completion of the module, students understand the fundamentals of describing and syntactically analyzing programming languages. They can file formal languages within the Chomsky hierarchy. They master current procedures to transform formal languages from one description form into another, as well as how to compile descriptions in normal forms or minimal forms. They can derive the intended language from a description. They understand that different description forms of calculation forms are equivalent and understand the processes to transform one form into another. They understand the main options and limits of predictability In particular, they understand the halting problem and how it cannot be solved.</td></tr>
<tr><td colspan="4">Contents:
Theoretical calculation models: Automata, Turing machines. Formal languages, language acceptors, regular expressions, grammars, Chomsky hierarchy, predictability, complexity</td></tr>
<tr><td>Forms of teaching and learning</td><td>On-campus studies
(hours per semester week = SWH)</td><td>Forms of active participation</td><td colspan="2">Work effort
(hours)</td></tr>
<tr><td>Lecture</td><td>3</td><td rowspan="2">Written work on assigned exercise sheets
Oral presentation of solutions to assigned exercises within exercises</td><td>On-campus time L
Preparation and follow-up L
On-campus time E
Preparation and follow-up E
Examination preparation and examination</td><td>45
30
30
75
30</td></tr>
<tr><td>Exercise</td><td>2</td></tr>
<tr><td colspan="2">Module exam:</td><td colspan="3">Written exam (90 minutes), the written exam can also be carried out in the form of an electronic examination (90 minutes).</td></tr>
<tr><td colspan="2">Course language:</td><td colspan="3">German</td></tr>
<tr><td colspan="2">Mandatory regular participation:</td><td colspan="3">Lecture: Participation recommended, exercise: Yes</td></tr>
<tr><td colspan="2">Total working time requirement:</td><td>210 hours</td><td colspan="2">7 CP</td></tr>
<tr><td colspan="2">Duration of module:</td><td colspan="3">One semester</td></tr>
<tr><td colspan="2">Frequency of course offering:</td><td colspan="3">Each summer semester</td></tr>
<tr><td colspan="2">Applicability:</td><td colspan="3">Bachelor’s degree course in informatics, bachelor's degree course Informatics for Teacher Training, Bachelor’s degree course in Bioinformatics</td></tr>
</table>

5. Subject area - Mathematics for computer scientists

Module: Logic and Discrete Mathematics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students are aware of fundamental concepts in logic, set theory, and combinatorial analysis. They can apply these to mathematical modeling of applications within informatics. They are able to understand mathematical proofs and also to develop simple proofs themselves in context with informatics-related problems. They can think abstractly and formalize simple matters within a logic. They master fundamental aspects of discrete mathematics and can apply combinatorial techniques in practice (such as in designing and analyzing algorithms).

Contents:

Propositional logic and mathematical proof techniques

– Boolean formulas and Boolean functions, DNF and CNF, satisfiability, resolution calculation

– Set theory: Sets, relations, equivalence and order relations, functions

– Natural numbers and complete induction, countability

– Predicate logic and mathematical structures

– Combinatorial analysis: Counting principles, binomial coefficients and Stirling numbers, recursion, pigeonhole principle, discrete probability distributions

– Graph theory: Graphs and their illustrations, paths and cycles in graphs, trees

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Written work on assigned exercise sheets Oral presentation of solutions to assigned exercises within exercises	On-campus time L	60
			Preparation and follow-up L	45
Exercise	2		On-campus time E	30
			Preparation and follow-up E	105
			Examination preparation and examination	30

Module exam:	Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes); the module exam is not evaluated separately.	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, exercise: Yes	
Total working time requirement:	270 hours	9 CP
Duration of module:	One semester	
Frequency of course offering:	Each winter semester	
Applicability:	Bachelors degree course in informatics, bachelor's degree course Informatics for Teacher Training	

Module: Linear algebra for informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students are aware of the basic terms and methods of linear algebra. They are able to determine application fields (such as from computer graphics, robotics, or statistical data analysis) that can be processed with methods of linear algebra. They can mathematically model such problems, and select and apply suitable solutions. They can explain phenomena of coding theory with the aid of linear algebra (over finite fields), classify corresponding problems and develop solutions.

Contents:

Linear algebra: Groups, rings, bodies, polynomial rings, vector spaces, basis and dimension; linear mapping, matrix and position; Gauss elimination and linear systems of equations; determinants, eigenvalues and eigenvectors; Euclidean vector spaces and orthonormalization; principle axis transformation

Applications of linear algebra in affine geometry, statistical data analysis, and coding theory (linear codes).

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Written work on assigned exercise sheets Oral presentation of solutions to assigned exercises within exercises	On-campus time L Preparation and follow-up L On-campus time E Preparation and follow-up E Written assigned exercises Examination preparation and examination	60 60 30 45 45 60
Exercise	2			
Module exam:		Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).		
Course language:		German		
Mandatory regular participation:		Lecture: Participation recommended, exercise: Yes		
Total working time requirement:		300 hours	10 CP	
Duration of module:		One semester		
Frequency of course offering:		Each summer semester		
Applicability:		Bachelor's degree program in Informatics		

Module: Analysis for informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module students know the number systems from the natural to complex numbers, and problems with representing these in computers. They can classify situations in which application problems (such as in movement planning for robots, or in optimization tasks) can be handled with the analysis tool. They are able to model such set tasks as well as to select and apply suitable solutions. They can describe the practical problems that arise when implementing processes from differential and integral calculus, as well as apply several numerical standard procedures. They are able to explain and analyze phenomena in practice using stochastic means.

Contents:

Structure of numerical ranges from natural to real numbers, polynomial interpolation; exponential and logarithm function, trigonometric functions; complex exponential function and complex roots; convergence of sequences and series, convergence and functional consistency; differential calculus: Derivation of a function, its interpretation and applications; partial derivatives; integral calculus: Definite and indefinite integral, fundamental theorem of differential and integral calculus, applications; power series; basic terminology of stochastics: Discrete and consistent probability spaces, independence of results; random variables and standard distributions; expected value and variance.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Written work on assigned exercise sheets Oral presentation of solutions to assigned exercises within exercises	On-campus time L Preparation and follow-up L On-campus time E Preparation and follow-up E Written assigned exercises Examination preparation and examination	60 60 30 45 45 60
Exercise	2			

Module exam:	Written exam (120 minutes), the written exam can also be carried out in the form of an electronic examination (120 minutes).	
Course language:	German	
Mandatory regular participation:	Lecture: Participation recommended, exercise: Yes	
Total working time requirement:	300 hours	10 CP
Duration of module:	One semester	
Frequency of course offering:	Each winter semester	
Applicability:	Bachelor's degree program in Informatics	

6. Subject area: Science

Module: Scientific work within informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students will be able to:

– gain knowledge of a topic within informatics under supervision based on academic literature

– master current lecture and presentation techniques

– appropriately consider gender and diversity aspects in lectures and presentations

– prepare a lecture in writing

– structure and write scholarly work regarding the lecture

– can place contents of an attended lecture in context and discuss it appropriately.

Contents:

The lecture is an introduction to scientific work. The fundamental forms of knowledge representation are described. Explanation is provided how informatics texts are written in an accessible manner and how these texts are read and reviewed. An introduction to legal, ethical, and philosophical problems in science and particularly informatics is also carried out. In addition, gender and diversity problems within informatics are introduced in lectures and strategies for solutions are mentioned. During the course, every student is assigned a topic that generally builds on the fundamentals learned during the first year of the study. These topics are introduced by the lecturers and the associated literature is stated in the announcement as well as in a preliminary discussion. Every participant selects one of these topics, prepares a piece of scholarly work under supervision, and also prepares a lecture on the topic.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	1	Written summary Participation in discussions regarding the lecture	On-campus time L	15
			Preparation and follow-up L	15
			On-campus time PS	30
Proseminar	2		Preparation and follow-up PS	30
			Examination preparation and examination	60
Module exam:		Oral presentation (ca. 30 minutes) with subsequent discussion (ca. 10 minutes)		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		Two semesters		
Frequency of course offering:		Each semester		
Applicability:		Bachelor’s degree program in Informatics		

II. Advanced module (with options)

Module: Fundamentals of Technical Computer Science

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

At the end of the module, students will be able to:

– map logical functions on physical circuits,

– understand and calculate simple circuits,

– comprehend the use of semiconductor technology in circuits,

– describe the transition from the analog to the digital world, and vice versa,

– assemble and analyze analog circuits,

– carry out integrated programming in Assembler and C,

– operate integrated systems, and

– Install software on integrated systems.

Contents:

The Fundamentals of Technical Computer Science module acts as the basis for understanding the functions of real computer systems. Based on this logic, the module primarily covers the areas of combinatorial and sequential circuits, logic minimization, gates, flip-flops, memories, automata, and simple hardware design. In addition, fundamental knowledge from the fields of DC and AC networks, semiconductors, transistors, CMOS, operational amplifiers, A/D and D/A converters is taught in as far as is required within informatics. Various practical experiments in the associated internship aim to build knowledge of computer architecture as well as operating and communication systems learned in the lectures within the module. Based on a simple hardware platform with processor and various interfaces, participants should learn how to program basic drivers, expand operating system routines and control the interfaces. The systems should then be networked and can interact with their environment.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2	Explanation and completion of at least 85 % of attempts	On-campus time L	30
			Preparation and follow-up L	60
			On-campus time SPC	60
Seminar on PC	4		Preparation and follow-up SPC	120
			Examination preparation and examination	30
Module exam:		Practical examination (illustration of theoretical backgrounds, test results, and minute book)		
Course language:		German		
Mandatory regular participation:		Lecture: Participation recommended, seminar on PC: Yes		
Total working time requirement:		300 hours	10 CP	
Duration of module:		One semester		
Frequency of course offering:		Each winter semester		
Applicability:		Bachelor's degree program in Informatics		

Module: Research internship

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: Successful completion of modules offering a total of 40 CP from the first two semesters as per the recommended study sequence for the bachelor's degree program.

Qualification objectives:

Students can plan and prepare an observation series that has already been designed (create measurement setup, test, calibrate, monitor) as well as carry it out and understand its connection with a research question. They can properly collect, categorize, and archive the observation data. They can evaluate and monitor the quality of data, and understand the effect of data quality on the validity of research. They can recognize data that affects the observation series, or is problematic in any way, and can annotate/adjust such data accordingly. They can analyze the collated data in accordance with stated criteria.

Contents:

The activities are carried out in close collaboration with, and under the direct supervision and with feedback from researchers directly in the context of their research work, so that forms and contents can vary dramatically whilst still being aligned with qualification objectives. The execution method (timeframes, classroom-based sessions, and support, work records, colloquium for determining grades, etc.) should be clarified and agreed upon with the lecturer beforehand.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Practical seminar	2	Prepared work results	On-campus time Preparation and follow-up Examination preparation and examination	30 90 30
Module exam:		Presentation of results (ca. 15 minutes) with discussion (ca. 15 minutes)		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours		5 CP
Duration of module:		One semester		
Frequency of course offering:		Irregular		
Applicability:		Bachelor's degree program in Informatics		

Module: Basic didactics in informatics

University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute

Persons responsible for module: Lecturer for the module

Admission requirements: Successful competition of the functional programming module, or the object-oriented programming module for students without programming knowledge, or the object-oriented programming module for students with programming knowledge

Qualification objectives:

The module covers fundamental didactic informatics knowledge and skills. The didactics behind informatics are introduced in the seminar, whilst the accompanying projects help apply, deepen, and expand the acquired knowledge from a research angle.

Contents:

- Reflection on introductions via the field of informatics
- Role of programming
- Development lines of specialist didactic designs
- Informatics training and general training
- Sociological conditions (gender aspects, extracurricular experiences, learning biographies within informatics)
- Classroom research project: Create, teach, reflect, and adapt learning processes in informatics

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Seminar	2	Read texts and introduce them for other participants, develop teaching materials and tasks, active participation in the classroom project (teaching, observing, evaluating)	On-campus time	60
			Preparation and follow-up	180
Research project	2		Examination preparation and examination	60
Module exam:		Description and analysis of a classroom project based on an individually developed research question with written composition (approx. 20 pages) plus annex (research instrument and data)		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		300 hours	10 CP	
Duration of module:		Two semesters		
Frequency of course offering:		Annually		
Applicability:		Bachelor's degree program in Informatics		

Module: Scientific work within practical informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Module Instructors

Admission requirements: Successful conclusion of the algorithms, data structures, and data abstraction module

Qualification objectives:

Students can independently acquaint themselves with a topic within practical informatics based on original scientific literature and, if required, gain additional background knowledge. They can clearly convey the topic in an oral presentation. In this case they can emphasize essential elements relative to less important ones, set individual statements out in relation to each other and summarize their core content. They can consciously select and use suitable forms of presentation and media. They are prepared to ask questions in case of ambiguity, can participate in a discussion regarding economic issues, and can also provide criticism in an objective manner. At the same time, students acquire more in-depth knowledge within a specific area in practical informatics and are prepared for their Bachelor's thesis.

Contents:

The module has differing focuses within the field of practical informatics (e.g. software engineering, database systems, data management, security within information technology, artificial Intelligence, modern web technologies).

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Advanced seminar	2	Oral presentation, written summary, regular discussion contributions	On-campus time AS Preparation and follow-up AS Examination preparation and examination	30 60 60
Module exam:		Written summary (ca. 4,500 words) with oral presentation (ca. 45 minutes)		
Course language:		German (English if necessary)		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		One semester		
Frequency of course offering:		Each semester		
Applicability:		Bachelor's degree program in Informatics		

Module: Scientific work within theoretical informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Module Instructors

Admission requirements: Successful conclusion of the algorithms, data structures, and data abstraction module

Qualification objectives:

Students can independently acquaint themselves with a topic within theoretical informatics based on original scientific literature and, if required, gain additional background knowledge. They can clearly convey the topic in an oral presentation. In this case they can emphasize essential elements relative to less important ones, set individual statements out in relation to each other and summarize their core content. They can consciously select and use suitable forms of presentation and media. They are prepared to ask questions in case of ambiguity, can participate in a discussion regarding economic issues, and can also provide criticism in an objective manner. At the same time, students acquire more in-depth knowledge within a specific area in theoretical informatics and are prepared for their Bachelor's thesis.

Contents:

The module has differing focuses within the field of theoretical informatics (e.g. algorithms, complexity, theory of programming languages).

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Advanced seminar	2	Oral presentation, written summary, regular discussion contributions	On-campus time AS 30 Preparation and follow-up AS 60 Examination preparation and examination 60
Module exam:		Written summary (ca. 4,500 words) with oral presentation (ca. 45 minutes)	
Course language:		German (English if necessary)	
Mandatory regular participation:		Yes	
Total working time requirement:		150 hours	5 CP
Duration of module:		One semester	
Frequency of course offering:		Each semester	
Applicability:		Bachelor's degree program in Informatics	

Module: Scientific work within technical informatics

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Module Instructors

Admission requirements: Successful completion of the computer architecture, operating and communication systems module.

Qualification objectives:

Students can independently acquaint themselves with a topic within technical informatics based on original scientific literature and, if required, gain additional background knowledge. They can clearly convey the topic in an oral presentation. In this case they can emphasize essential elements relative to less important ones, set individual statements out in relation to each other and summarize their core content. They can consciously select and use suitable forms of presentation and media. They are prepared to ask questions in case of ambiguity, can participate in a discussion regarding economic issues, and can also provide criticism in an objective manner. At the same time, students acquire more in-depth knowledge within a specific area in technical informatics and are prepared for their Bachelor's thesis.

Contents:

The module has differing focuses within the field of technical informatics (e.g. mobile communication, sensor networks, or robotics).

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Advanced seminar	2	Oral presentation, written summary, regular discussion contributions	On-campus time AS	30
			Preparation and follow-up AS	60
			Examination preparation and examination	60
Module exam:		Written summary (ca. 4,500 words) with oral presentation (ca. 45 minutes)		
Course language:		German (English if necessary)		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		One semester		
Frequency of course offering:		Each semester		
Applicability:		Bachelor's degree program in Informatics		

III. Field of study general professional skills

1. Competence area Subject-Related Additional Qualifications

<table>
<tr><td colspan="4">Module: Software project A</td></tr>
<tr><td colspan="4">University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics</td></tr>
<tr><td colspan="4">Persons responsible for module: Lecturer for the module</td></tr>
<tr><td colspan="4">Admission requirements: Successful conclusion of the software technology module</td></tr>
<tr><td colspan="4">Qualification objectives:

Students can successfully use their technical software knowledge and qualifications in a small software project and apply the corresponding procedures. They can, with guidance, divide a larger project into tasks and sub-products as well as define interfaces between these. They understand the necessity of these interfaces and potential problems with subsequent integration. They understand quality, expense, acceptance, and success factors of a software project. They can communicate both orally and in writing in a project team with more than five members, coordinate, and successfully plan a software project under supervision. They can manage their workload by themselves. They are able to evaluate the quality of their solutions within the context of the overall project. They can use tools for carrying out and managing a project. They can appropriately show their results orally and in writing.</td></tr>
<tr><td colspan="4">Contents:

The implicit knowledge (tacit knowing) is suitable for software development in the software project. A larger software system is developed collaboratively in a team by students under supervision from the lecturer. In this case all phases of a software project should take place in the same manner as within a modern company, and typical methods that were learned in the Software Technology module should be used based on the typical tools and aids found in company use. Typical examples of software components and tools within companies are introduced and tested for all tasks that arise.</td></tr>
<tr><td>Forms of teaching and learning</td><td>On-campus studies
(hours per semester week = SWH)</td><td>Forms of active participation</td><td>Work effort
(hours)</td></tr>
<tr><td>Project seminar</td><td>2</td><td>Successful handling and documenting of sub-tasks, interim presentations, participation in discussions. Presentation of results and project experience with subsequent discussion</td><td>On-campus time 30
Preparation and follow-up 240
Examination preparation and examination 30</td></tr>
<tr><td colspan="2">Module exam:</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Course language:</td><td colspan="2">German</td></tr>
<tr><td colspan="2">Mandatory regular participation:</td><td colspan="2">Yes</td></tr>
<tr><td colspan="2">Total working time requirement:</td><td>300 hours</td><td>10 CP</td></tr>
<tr><td colspan="2">Duration of module:</td><td colspan="2">Block of 8 weeks or a semester</td></tr>
<tr><td colspan="2">Frequency of course offering:</td><td colspan="2">Each semester</td></tr>
<tr><td colspan="2">Applicability:</td><td colspan="2">Bachelor’s degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor’s Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications)</td></tr>
</table>

Module: Software project B

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: Successful conclusion of the software technology module

Qualification objectives:

Students can successfully use their technical software knowledge and qualifications in a small software project and apply the corresponding procedures. They can, with guidance, divide a larger project into tasks and sub-products as well as define interfaces between these. They understand the necessity of these interfaces and potential problems with subsequent integration. They understand quality, expense, acceptance, and success factors of a software project. They can communicate both orally and in writing in a project team with more than five members, coordinate, and successfully plan a software project under supervision. They can manage their workload by themselves. They are able to evaluate the quality of their solutions within the context of the overall project. They can use tools for carrying out and managing a project. They can appropriately show their results orally and in writing.

Contents:

The implicit knowledge (tacit knowing) is suitable for software development in the software project. A larger software system is developed collaboratively in a team by students under supervision from the lecturer. In this case all phases of a software project should take place in the same manner as within a modern company, and typical methods that were learned in the Software Technology module should be used based on the typical tools and aids found in company use. Typical examples of software components and tools within companies are introduced and tested for all tasks that arise.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Project seminar	2	Successful handling and documenting of sub-tasks, interim presentations, participation in discussions	On-campus time 30 Preparation and follow-up 240 Examination preparation and examination 30
Module exam:		Presentation of results and project experience (15 minutes); the module exam is not evaluated separately.	
Course language:		German	
Mandatory regular participation:		Yes	
Total working time requirement:		300 hours	10 CP
Duration of module:		Block of 8 weeks or a semester	
Frequency of course offering:		Each semester	
Applicability:		Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor's Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications)	

Module: Methodology of work and life

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students can apply the following methods for developing personal skills that are related to practice, develop different forms of application, and assess the appropriateness of their use:

1. setting and determinedly pursuing specific, realistic, motivating objectives,
2. targeted enhancement of self-confidence,
3. communication in explaining own expectations and those of others, as well as stating that something is complete,
4. convenient formation of one's own subjective world view,
5. detection and processing of previously unknown programs,
6. encourage own motivation,
7. prioritizing values and balancing competing aspects of life.

Contents:

Psychological fundamentals of the above methods, details regarding the methods (such as rules of setting objectives, feedback rules), specific forms of use, discussion of benefits and disadvantages. Discussion of specific applications in the current life situations of all students.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Tuition in seminars	3	Regular participation in discussions; task-based work and presentations Individual and group projects	On-campus time Preparation and follow-up	45 105

Module exam:	None	
Course language:	German	
Mandatory regular participation:	Yes	
Total working time requirement:	150 hours	5 CP
Duration of module:	One semester	
Frequency of course offering:	Each winter semester	
Applicability:	Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications)	

Module: Start-up in the IT industry

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students will be able to develop their own business model and work out a professional business plan. They can carry out market, competitor, and SWOT analysis as well as select an appropriate legal structure and financing for starting up a business. They have the necessary technical skills required for a successful start-up (designing IT industry-specific business models and assessing their quality, carrying out market analyses, developing finance plans, selecting legal structure. Creation of a business plan for a business idea within the IT industry). They can set up a start-up team and identify skills and expansion opportunities with skills that are not related to IT. They can present their business model and business plan in pitches to potential investors.

Contents:

Successful business models, golden rules of starting up a business, business plan, financing, legal structure, marketing. A business plan is set up as part of a business plan competition within the course, along with external experts from the start-up industry. Amongst other things, case examples are shown in guest lectures from interns.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Project seminar	2	Regular participation in discussions, completing tasks individually or in a team, presentation of a business plan	On-campus time Preparation and follow-up Examination preparation and examination	30 90 30
Module exam:		Written summary of a presentation (approx. 1,500 words); the module exam is not evaluated separately.		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		One semester		
Frequency of course offering:		Each winter semester		
Applicability:		Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor's Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications)		

Module: Social aspects of Practical Computer Science

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students can understand and classify examples of informatics systems and their effects on society. On the other hand, they understand how the needs of society influence informatics systems. They can describe and evaluate how informatics and informatics systems are able to eradicate disadvantages as well as create such in the first place. They are able to describe and classify such interactions between systems, individuals, and society, and derive specific action strategies from such. They can present research findings in an appropriate manner for the receiver.

Contents:

Advances and new applications within informatics, as well as societal aspects and effects of the application (such as man-machine interaction, accessibility, equal opportunity, effect of informatics systems on the gender ratio, personnel management, documentation)

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Seminar exercise	3	Participation in discussions in the seminar, presentation of own research findings, oral presentations	On-campus time	45
			Preparation and follow-up	75
			Examination preparation and examination	30
Module exam:		Written summary of a presentation (approx. 2,000 words); the module exam is not evaluated separately.		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		One semester		
Frequency of course offering:		Irregular		
Applicability:		Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor's Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications), Master's Degree Course in Mathematics: Practical informatics		

Module: Legal aspects of Practical Computer Science

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students understand interactions with information systems or development of such systems from a legal perspective. They have an overview of relevant legislation in the areas of patent law, copyright law, utility model protection, trademark protection, data protection, or product liability law. They can establish fundamental problems and classify it to a legal area based on practical examples. They can present their research results, derive specific action strategies from them and discuss these in the group in order to develop legally watertight informatics systems or to operate them.

Contents:

Advances and new applications in informatics as well as legal aspects of the application in societal contexts (such as data protection, patent law, legal protection, contract law, copyright law)

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2	Participation in discussions in the seminar, presentation of own research findings, short presentations, written preparation	On-campus time	60
Exercise	2		Preparation and follow-up	90
Module exam:		None		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		March to August		
Frequency of course offering:		Annually		
Applicability:		Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor's Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications), Master's Degree Course in Mathematics: Practical informatics		

Module: Planning, performing, and analysis of an informatics tutorial

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: Successful completion of the modules in functional programming and the logic and discrete mathematics

Qualification objectives:

Students understand different models of teaching, learning, and of knowledge transfer. They understand that new students may have differing motivations and can develop teaching offers accordingly. They can resolve misunderstandings and react appropriately to problems relating to group dynamics. They can prepare, carry out, and analyze a tutorial in the mandatory part of their core subject.

Contents:

Teaching and learning models, as well as methods for tutorials in mathematics and informatics are introduced and discussed in a preliminary discussion after the lecture period of the previous semester. During the semester break, an introductory discussion takes place with the tutor selection committee which covers the suitability of the tutor. After suitability has been successfully carried out, then a tutorial for the individually selected event in the mandatory part is prepared, performed, documented, then analyzed. In this case, the student is accompanied in a practical seminar assigned to the event, in which specific methods are introduced and discussed, and current problems are analyzed as well as solution strategies being covered. Classic conflict situations are mentioned, and strategies to solve problems are discussed. Finally, methods and criteria for analysis and documentation of a tutorial including learning success and teaching success are introduced.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Practical seminar	3	Supervising the tutorial, reliable documentation of results of every tutorial carried out; consultation meeting regarding the success of the supported tutorial	On-campus time 45 Preparation and follow-up 105

Module exam:	None	
Course language:	German	
Mandatory regular participation:	Yes	
Total working time requirement:	150 hours	5 CP
Duration of module:	One semester	
Frequency of course offering:	Each semester	
Applicability:	Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor's Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications)	

Module: Foundations of managing IT projects

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: Successfully completed the Software Technology module, or a professional internship, or a software project

Qualification objectives:

Students can describe and apply the processes of project planning and management during the typical life cycle of a project. They can be qualified to take part in supervising a medium-sized product, independently draw up project process and cost planning, supervise execution of these, then draw up a project conclusion report. Students master the relevant features of a software tool (e.g. MS Project).

Contents:

Essential principles, methods, and procedures within project management based on recognized methodology (e.g. “Project Management Body of Knowledge” (PMBoK)). The event focuses on the topic areas of project management that are relevant for project planning and monitoring with particular regard to the process and the costs:

– Project creation, definition, and planning of project scope

– Costs and process planning

– Project sequence monitoring and cost control

– Project status determination and reporting

– Sub-contracting

– Project closure

– Use of e.g. MS Project for such activities

This module therefore covers the typical fields of activity for an assistant to project management. It also provides fundamental project management knowledge that a member of a project in a prominent position in the project team would find indispensable.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Tuition in seminars	2	Regular contributions to discussion, a presentation, work on assigned exercises	On-campus time	30
			Preparation and follow-up	90
			Examination preparation and examination	30
Module exam:		Written exam (60 minutes), the written exam can also be carried out in the form of an electronic examination (60 minutes), or an oral examination (approx. 20 minutes); the module exam is not evaluated separately.		
Course language:		German		
Mandatory regular participation:		Yes		
Total working time requirement:		150 hours	5 CP	
Duration of module:		One semester		
Frequency of course offering:		Each winter semester		
Applicability:		Bachelor’s degree program in Informatics: Field of study ABV (subject-related additional qualifications), Bachelor’s Degree Course in Mathematics: Field of study ABV (subject-related additional qualifications)		

Module: System management

University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics

Persons responsible for module: Lecturer for the module

Admission requirements: None

Qualification objectives:

Students know and understand basic tasks within system management. They understand the fundamental concepts of handling operating systems, and the ethical and legal aspects in handling administrative privileges. They can responsibly handle such circumstances. They understand the special procedures when handling personal data, or with security classifications with essential systems and are aware of the problems in delegating administrative tasks. They can handle the tools for managing operating materials and automate routine activities in an appropriate manner. They can use system management tools. They understand the possibilities in improving the reliability of systems, and can apply these.

Contents:

Basic tasks of system management:

– Planning and installing systems whilst bearing the requirements in mind (applications, availability aspects, etc.)

– Installation and maintenance under various conditions (several administrators - one computer, one administrator - many computers, automation)

– Management of configuration data and documentation

– Joint use of resources (file services, print services, etc.)

– Accounting and logging, data back-up

– Strategies and technologies

– Realization on different platforms (Unix/Linux, Windows)

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2	Regular work on assigned tasks	On-campus time L	30
			Preparation and follow-up L	30
Internship	3		On-campus time I	15
			(supervised self-study in lab)	30
			Preparation and follow-up I	30
			Examination preparation and examination	15

Module exam:	Practical exam - preparation and performance of a typical task with subsequent discussion of said task (approx. 45 minutes); the module exam is not evaluated separately.	
Course language:	German	
Mandatory regular participation:	Yes	
Total working time requirement:	150 hours	5 CP
Duration of module:	One semester	
Frequency of course offering:	Each summer semester	
Applicability:	Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualifications)	

2. Occupational informatics internship

Module: Occupational informatics internship			
University/Faculty/Institute: Free University of Berlin/Mathematics and Informatics/Informatics			
Persons responsible for module: Internship advisor			
Admission requirements: None			
Qualification objectives: Students have interdisciplinary knowledge and skills as well as experiences from the working world of informatics that are relevant for finding and practicing vocational activities in line with their qualifications on European and international labor markets. They can apply strategies for successfully finding an internship, as well as design it.			
Contents: A selected field of activity is introduced on site in practice, in which the previously acquired specialist and key skills can be tested in specific day-to-day work scenarios. The module provides the option of effectively designing the practical phase through intensive preparation and reflection. Students focus on questions of career guidance and application and have the opportunity to exchange experiences regarding the specific work process. The module covers strategies for successfully finding an internship, whilst allowing for reflection on topic-specific and transferable knowledge, skills, and competences, as well as experience from the world of work that is relevant for discovering and carrying out professional activities on European and international labor markets which are appropriate for the level of qualification and which are also relevant for lifelong learning.			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Occupational internship	16	Internship-related activities and tasks Discussion contributions, internship report	On-campus time 240 Preparation and follow-up 60
Module exam:		None	
Course language:		German	
Mandatory regular participation:		Yes	
Total working time requirement:		300 hours	10 CP
Duration of module:		6 to 8 week internship in a block during the time between terms	
Frequency of course offering:		Each semester	
Applicability:		Bachelor's degree program in Informatics: Field of study ABV (subject-related additional qualification)	

Annex 2: Examples of courses of study

2.1 Starting studies in the winter semester

<table>
<tr><th>Semester</th><th>Algorithms and programming</th><th>Technical computer science</th><th>Theoretical computer science and practical computer science</th><th>Mathematics for informatics</th><th>Science</th><th>Application area</th><th>ABV (courses in General Professional Skills)</th><th>SWH</th></tr>
<tr><td>1. FS 28 CP</td><td>Functional Programming (9 CP)</td><td rowspan="2">Computer Architecture, Operating and Communication Systems (10 CP)</td><td></td><td>Logic and Discrete Mathematics (9 CP)</td><td></td><td></td><td>ABV (5 CP)</td><td>18</td></tr>
<tr><td>2. FS 30 CP</td><td>Object-oriented Programming (8 CP)</td><td>Fundamentals of Theoretical Computer Science (7 CP)</td><td>Linear algebra for informatics (10 CP)</td><td rowspan="2"></td><td></td><td></td><td>20</td></tr>
<tr><td>3. FS 29 CP</td><td>Algorithms, Data Structures, and Data Abstraction (9 CP)</td><td></td><td>Effects of informatics (5 CP)</td><td>Analysis for informatics (10 CP)</td><td></td><td>ABV (5 CP)</td><td>18</td></tr>
<tr><td rowspan="2">4. FS 31 CP</td><td rowspan="2">Non-sequential and distributed programming (9 CP)</td><td rowspan="2"></td><td>Database systems (7 CP)</td><td rowspan="2"></td><td rowspan="2">Scientific work within informatics (5 CP)</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">18</td></tr>
<tr><td>Software technology (10 CP)</td></tr>
<tr><td>5. FS 30 CP</td><td colspan="4">Specialist field (10 CP)</td><td></td><td>Application area (10 CP)</td><td>Occupational internship (10 CP)</td><td>12</td></tr>
<tr><td>6. FS 32 CP</td><td colspan="4">Specialist field (5 CP)</td><td>Bachelor’s thesis with presentation of results (12 CP)</td><td>Application area (5 CP)</td><td>Software project (10 CP),</td><td>12</td></tr>
</table>

2.2 Starting studies in the summer semester

Semester	Algorithms and programming	Technical computer science	Theoretical computer science and practical computer science	Mathematics for informatics	Science	Application area	ABV (courses in General Professional Skills)	SWH
1. FS 28 CP	Object-oriented Programming (8 CP)	Computer Architecture, Operating and Communication Systems (10 CP)		Linear algebra for informatics (10 CP)			ABV (5 CP)	18
2. FS 28 CP	Functional Programming (9 CP)		Effects of informatics (5 CP)	Logic and Discrete Mathematics (9 CP)				19
3. FS 32 CP			Fundamentals of Theoretical Computer Science (7 CP)		Scientific work within informatics (5 CP)	Application area (5 CP)	ABV (5 CP)	17
			Software technology (10 CP)					
4. FS 29 CP	Algorithms, Data Structures, and Data Abstraction (9 CP)			Analysis for informatics (10 CP)			Software project (10 CP)	14
5. FS 31 CP	Non-sequential and distributed programming (9 CP)		Database systems (7 CP)			Application area (5 CP)	Occupational informatics internship (10 CP)	15
6. FS 32 CP	Specialist field (15 CP)				Bachelor's thesis with presentation of results (12 CP)	Application area (5 CP)		9

Annex 3: Report of Grades (sample)

Free University of Berlin
Faculty of Mathematics and Informatics

Report of Grades

Ms./Mr. [first name/last name]

Date of birth [day/month/year] in [place of birth]

has successfully completed the Bachelor's Program in
Informatics

on the basis of the Examination Regulations of 16 July 2014 (FU Announcements 35/2015) with the overall grade

[grade as number and text]

and earned the required number of 180 credits.

Evaluation of examination results:

Field(s) of study	Credit points	Grade
Area of informatics, of which	135 (…)	n,n
• 108 (94) CP in Informatics as a mandatory part		n,n
• 15 (15) CP in Informatics as a specialist field		n,n
• 12 (12) CP for the Bachelor's thesis		n,n
Application area	15 (…)	n,n
General Professional Skills (ABV)	30 (…)	BE/n,n

The them of the Bachelor's Thesis was: [XX]

Berlin, this day of [day/month/year] (seal)

Dean Chairman of the Examination Committee

Grading scale: 1.0 – 1.5 very good; 1.6 – 2.5 good; 2.6 – 3.5 satisfactory; 3.6 – 4.0 sufficient; 4.1 – 5.0 insufficient
Grades not evaluated separately: BE – passed; NB – not passed
The credit points are in accordance with the European Credit Transfer and Accumulation System (ECTS).
Some study work is not graded; the credit points in parentheses reflect the scope of graded performance levels that impact the overall grade.

Annex 4: Diploma (sample)

Free University of Berlin
Faculty of Mathematics and Informatics

Certificate

Ms./Mr. [first name/last name]

Date of birth [day/month/year] in [place of birth]

has successfully completed the Bachelor's Program in

Informatics

.

Based on the Examination Regulations of 16 July 2014 (FU Announcements No. 35/2014)

the university degree

Bachelor of Science (B. Sc.)

is awarded.

Berlin, this day of [day/month/year] (seal)

Dean Chairman of the Examination Committee

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