Curriculum
Computer Science

2013

Academy Profession (AP) Degree
In Computer Science

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ERHVERVSAKADEMI
AARHUS

Part 1: Joint section

1   General comments

Curriculum

This curriculum for the degree programme in Computer Science has been developed as set out in Executive Order no. 702 of 3 July 2009 on the Academy Profession degree programme (AP) for Information Technology (AP Degree in Computer Science). The common part of the curriculum has been developed jointly by the educational institutions offering the programme and applies to all courses under the approved degree programme.

1.1   Programme Objective

The programme aims at qualifying the students to independently perform the job of analysing, planning and realising solutions concerning development, enhancement and integration of IT systems in private and public enterprises in Denmark and internationally.

1.2   Titles of Programme and Graduates

The degree programme is called the AP Degree Programme in Computer Science.
Having completed the Computer Science Programme, students are entitled to call themselves "Datamatiker AK" in Danish.
In English the title is Academy Profession Degree in Computer Science.

1.3   Admission

Admission to the programme is governed by Executive Order no. 210 of 1 March 2013 on admission to Academy Profession and Bachelor's Degree Programmes.

Reference is made to **www.retsinfo.dk**

1.4   Duration

The programme, a full-time course, comprises 2½ student years, equivalent to 150 ECTS credits. One student-year is equivalent to a full-time student's work in one year and 60 ECTS points.

The work load denoted in ECTS credits includes timetabled classes and guidance, preparation for classes, written reports, any other activities in connection with the tuition, study trips and projects in selected companies in addition to self-study and participation in exams.

Students must complete their studies on this programme 4½ years after they have started on the programme at the latest (prescribed study period plus two years). However, under unusual circumstances exemptions to the latest date of completion may be granted (cf section 5(2) of Executive Order no. 636 of 29 June 2009).

1.5   Objectives for learning achieved

The objectives for the learning outcome comprise the knowledge, skills and competences that a graduate with an AP degree in Computer Science must achieve during the programme, cf Executive Order No 702 of 3 July 2009 on Academy Profession degree programme (AP) for Information Technology (AP Degree in Computer Science).

Knowledge:

The graduate has knowledge about:

1. standard applied practice, theory and method in relation to software development
2. fundamental company operations in relation to software development and
3. the technological concepts and the technological platform of computer systems in relation to programming, error tracing and commissioning.

Skills

The graduate is able to:

1. methodically identify requirements to IT systems, comprising assessment of whether the requirements are feasible within the set framework
2. apply state-of-the-art programming techniques and tools for software construction, including ensure the quality of the developed product
3. document the work performed in a manner which makes the documentation useful to the specified target group
4. apply relevant knowledge in connection with system development, programming and commissioning
5. systematically perform error tracing and error repairs in connection with IT systems
6. assess practice-related problems in relation to computer systems and select solution options and
7. communicate practice-related problems and solution options to cooperation partners and users.

Competences:

The graduate is able to:

1. participate in the development of the practical aspects of software development
2. participate in project work in a competent manner
3. participate in professional and interdisciplinary cooperation in connection with software development applying a professional approach
4. participate in a process for development of a system applying state-of-the-art methods, techniques and tools and
5. in a structured context acquire new knowledge, skills and competences in relation to the IT industry, including domain knowledge and technological knowledge and application of new methods, techniques and tools.

2   The Contents and Structure of the Programme

2.1 Structure

The subjects and activities under the degree programme are awarded credits according to the European Credit Transfer System (ECTS). Using this formalised ECTS credit system, it is possible to transfer credits from this programme to other programmes in Denmark and abroad.

The programme comprises compulsory educational elements, electives, internship and a final exam project.

The compulsory educational elements total 100 ETCS credits and these elements are common for all students.

For each student the electives total 20 ECTS credits.

The internship totals 15 ECTS credits. The final exam project totals 15 ECTS credits.

The compulsory elements of the programme fall under the following core areas:

- Programming   40 ECTS
- Systems Development   25 ECTS
- Technology   20 ECTS
- Business Understanding   15 ECTS

The programme also comprises the following elements:

- Specialisation   20 ECTS
- Internship   15 ECTS
- Final exam project   15 ECTS

The ECTS credits are divided onto the semesters as shown in the table below.

Computer Science ECTS distribution	1st sem	2nd sem	3rd sem	4th sem	5th sem	
Programming	15 ECTS	10 ECTS	15 ECTS			40 ECTS
Systems Development	5 ECTS	5 ECTS	5 ECTS	10 ECTS		25 ECTS
Technology		10 ECTS	10 ECTS			20 ECTS
Business Understanding	10 ECTS	5 ECTS				15 ECTS
Electives/ specialisation process				20 ECTS		20 ECTS
Internship					15 ECTS	15 ECTS
Final exam project					15 ECTS	15 ECTS
	30 ECTS	30 ECTS	30 ECTS	30 ECTS	30 ECTS	150 ECTS

Each of the core areas are included in the subjects divided across the semesters of the programme, as show in the following table.

A description of the knowledge, skills and competences of the individual core areas can be found in Appendix 1.

Table: Overview of relationship between core areas and subjects

	1st sem	2nd sem	3rd sem	4th sem	5th sem
Programming	**Software Construction 25 ECTS** • Programming languages • Database programming • Language theory • Program quality • Algorithms • Templates, techniques and patterns • Data structures and abstract data types • Synchronisation		**Software architecture and Distributed Programs 15 ECTS** • Synchronisation • Distributed programming • Software architecture • Language theory • Program quality • Algorithms • Data structures and abstract data types • Templates, techniques and patterns		
Systems Development	**Software Design 10 ECTS** • Modelling • Method • Analysis • Designs • Project work • IT tools • Experiments • Quality		**Systems Development Methods 15 ECTS** • Method • Designs • Project work • IT tools • Experiments • Analysis • Quality		
Technology		**Computer Architecture and Operative Systems 10 ECTS** • Operating systems • Technology development • Databases • Networks	**Computer Networks and Distributed Systems 10 ECTS** • Security • Distributed systems • Networks • Databases		
Business Understanding	**Information Technology in Organisations 15 ECTS** • Organisational and commercial understanding • Business analysis • IT and business concepts • Financial management • ERP systems				

	• IT procurement • Organisation and IT security				
Electives/Internship & Final exam project				20 ECTS	30 ECTS

2.2   Educational Elements – 1st year (1st and 2nd semesters)

The compulsory educational elements are taught as a series subjects in the 1st and 2nd years of the programme.

2.3   Learning Objectives – 1st year

Objective

The objective of the 1st year of studies is to give the students competences to develop primarily single-user systems, independently and in cooperation with others. Professionally the year of study ranges from pre-analysis to management and operation. This is done via a systematic approach involving technological and business-related aspects.

2.3.1   The Subject Software Construction

The objective of the subject is to qualify the student to effectively realise systems with relevant qualities. The subject is closely related to the subjects Software Design and Computer Architecture and Operative Systems.

Learning Outcomes:

Knowledge:

Student has knowledge about:
- criteria for program quality
- descriptions of syntax and semantics of formal languages.

Skills:

The student is able to apply the selected language and development environment as well as the selected database system to realise minor systems with a consideration to:
- appropriate architecture
- traceability to other systems development activities
- quality assurance
- appropriate application of fundamental algorithms, data structures, patterns

Competences:

The student is able to:

Development competence:
- reflect on his own practise.

Cooperation competence:
- participate in professional program development cooperation.

Learning competence:
- apply the common information sources of the subject area the student can acquire relevant knowledge when solving concrete programming tasks.

2.3.2 The Subject Software Design

The objective of the subject is to qualify the student to develop, enhance and integrate various types of IT systems on a systematic basis applying specific modern methods and attached systems development tools. The subject qualifies the student to ensure that correct IT systems with relevant qualities are developed effectively and in this way links together the other subjects of the 1st year of studies.

Learning Outcomes:
Knowledge:
Student has knowledge about:
- the importance of modelling in connection with systems development
- the importance of experiments as part of or as supplement to the systems development method
- the importance of quality criteria for the systems development process and the final design of the system.

Skills:
The student is able to apply the selected systems development method with relevant tools for the development of minor database-based systems from idea to running system with consideration to:
- appropriate architecture
- documentation and traceability
- quality assurance
- appropriate use of patterns
- user involvement
- user interface design.

Competences:
The student is able to:

Development competence:
- reflect on his own practise with regard to method and process.

Cooperation competence:
- enter as a competent participant in a development project.

2.3.3 The Subject Computer Architecture and Operative Systems

The objective of the subject area is to qualify the student to contribute to selection and application of technology in connection with systems development and programming of single-user and multiple-user systems as well as to give the student basic knowledge of technological aspects.

Learning Outcomes:
Knowledge:
Student has knowledge about:
- facilities in and the construction of modern operative systems
- interaction between programming language and operative system
- the technological development, including development tendencies
- facilities in and function of a modern DBMS

- multiple-user problems.

Skills:
The student is able to:
- apply mechanisms for synchronising processes and threads.

Competences:
The student is able to:

Learning competence:
- acquire knowledge about new operative systems and DBMSs.

2.3.4   The Subject Information Technology in Organisations

The objective of the subject is to qualify the student to include relevant company aspects as well as business understanding in connection with systems development. The subject area qualifies the student to work in a systems development organisation and to participate in development, enhancement and integration of IT systems for different types of organisations.

Learning Outcomes:
Knowledge:
Student has knowledge about:
- key organisational concepts
- e-business and IT strategy
- IT procurement.

Skills:
The student is able to include relevant company aspects in the development, adaptation and implementation of IT systems including:
- prepare business analyses
- analyse the organisation of IT security
- apply ERP systems
- financial management.

Competences:
The student is able to:

Development competence:
- understand IT's potential for developing the business.

Cooperation competence:
- cooperate with representatives from the user organisation and the development organisation based on business understanding
- participate in project work.

Learning competence:
- acquire knowledge about new technology.

2.4 Learning Objectives – 2nd year

The objective of the 2nd year of studies is to give the student competence to assess a company's IT development potential independently and in cooperation with others and based on this to develop, enhance and maintain a distributed IT system from preliminary analysis to management and operation via a methodical and systematic approach depending on the situation.

2.4.1 Systems Development Methods

The objective of the subject is to qualify the student to develop, enhance and integrate various types of distributed IT systems on a systematic basis applying modern methods and systems development tools depending on the situation. The subject qualifies the student to ensure that correct IT systems with relevant qualities are developed effectively and in this way links together the other compulsory of the 2nd year of studies.

Learning Outcomes:
Knowledge:
Student has knowledge about:
- the importance of quality criteria for the systems development process and the final design of the system.
- the relevance of experimenting as part of or as supplement to systems development methods

Skills:
The student is able to:
- in a given situation choose a system development model based on systematic comparison
- work systematically on a project using a selected system development method
- relate specific methods to relevant process models
- plan, assess and manage a minor project
- document and communicate product and process in connection with systems development.

Competences:
The student is able to:

Development competence:
- adjust a systems development method to a project in a manner appropriate to the situation.

Cooperation competence:
- participate as a competent partner in a development project.

Learning competence:
- learn new process models and system development methods
- reflect on process and method in practice.

2.4.2 The Subject Software Architecture and Distributed Programs

The subject qualifies the student to effectively realise distributed systems with the relevant qualities. The subject is a core subject with close relations to the other compulsory subjects in the 2nd year of studies

Knowledge:
The student has knowledge about:
- qualitative and quantitative features of classic data structures and algorithms
- descriptions of syntax and semantics of formal languages
- abstraction mechanisms in modern programming languages.

Skills:
The student is able to apply the selected language(s) and IDE with appertaining APIs to realise distributed systems and do complex programming tasks with consideration to:
- appropriate choice of fundamental algorithms, data structures, patterns
- appropriate choice of architecture
- synchronization problems and cooperating processes
- program quality achieved by the application of relevant tools.

Competences:
The student is able to:

Development competence:
- participate in the development and adaptation of programming techniques and methods.

Cooperation competence:
- enter in dialogue with other professionals about quality of product and process.

Learning competence:
- reflect on applied programming practise
- acquire new programming languages with appertaining APIs and IDEs.

2.4.3   The Subject Computer Networks and Distributed Systems
The objective of the subject is to qualify the student to contribute to selection and application of technology in connection with systems development and programming of distributed IT systems as well as to give the student in-depth knowledge of technological aspects.

Learning Outcomes:
Knowledge:
Student has knowledge about:
- key security-related concepts and threats
- principles of designing and realising distributed systems
- fundament network concepts.

Skills:
The student is able to include relevant technological aspects in the development of distributed systems including:
- appropriate systems architecture
- application of a programming interface for communication networks
- application of standard components for secure communication
- application of widespread application protocols.

Competences:
The student is able to:

Cooperation competence:
- cooperate with the operating organisation.

Learning competence:
- acquire knowledge about new technology.

2.5 Elective Element: Specialisation (20 ECTS)

The objective of the specialisation is to allow the students to acquire individual profiles in relation to their studies through detailed studies within the scope of the degree programme.

Specialised subjects differ for each educational institution. Details about the elective educational elements can be found in the institution-specific part.

2.6 The Internship (15 ECTS)

The internship allows the student to work with relevant professional issues and to gain knowledge regarding relevant work functions. The student is associated with one or more private or public companies during the internship. The internship forms the basis for the student's final project and can be planned to allow both flexibility and differentiation. The internship takes place after the 1st year of studies.

The objective of the internship is to give the student the opportunity to test in practice the learning outcomes of the previous educational elements by staying at job-like terms in a company and job function which is relevant to the profession, thereby.

- gain insight into what organisations expect and require of their knowledge, skills and attitudes toward work
- experience the everyday work routines and tasks characteristic to the profession over a substantial period of time in the profession
- work with development assignments in practice in line with the student's own learning objectives
- try out in practice the knowledge and skills gained through the Computer Science Programme
- gain experience using other methods and tools required to complete specific professional tasks.

This can be supplemented by:

- get ideas for the final project and perhaps a basis for the final project.

Learning Objectives for the Internship
The internship is to relate to the business environment and the competences required in relation to information technology. The internship is organised so that it – when combined with the other parts of the degree programme – helps the student develop practical qualifications. The objective of the internship is to enable to the student to apply the methods, theories and tools taught by the programme and thereby solve specific practical assignments in relation to information technology

in Denmark or abroad. The internship is to be designed such that a progression towards independent execution is achieved.

Knowledge
The student has development-based knowledge and understanding of
- the application of theory, methods and tools as practiced by a professional within the industry.

Skills
The student is able to:
- apply a variety of the technical and analytical approaches associated with employment within this industry
- assess practice-related problems and propose solutions
- communicate practice-related problems and state reasons for the proposed solution(s).

Competences
The student is able to:
- manage development-oriented practical and professional situations as encountered in the industry
- acquire new knowledge, skills and competences in relation to the industry
- manage how to structure and plan day-to-day assignments typical of the industry
- participate in professional and interdisciplinary cooperation with a professional approach.

The student identifies – jointly with the host company and the Academy – additional individual learning objectives for the internship.

2.7 Final Exam Project (15 ECTS)
The purpose of the final exam project is for the student to document his/her ability to process complex and practical issues relating to a specific IT-related task using an analytical approach and relevant methodologies. The scope of the project must equal 15 ECTS credits. The student must complete the final exam project within the context of core issues of relevance to the degree programme.

Learning Outcomes:
Knowledge
The student has development-based knowledge and understanding of
practice and applied core theory in relation to a practice-related problem based on a specific assignment within the scope of information technology.

Skills:
In a practice-related project the student can:
- assess and choose methods and techniques relevant to the project
- command the methods and techniques used in the project
- plan, manage and implement a project using relevant methods and techniques
- document his/her results and the work process with regard to the chosen method(-ies).

Competences:
The student is able to:

Development competence:
- adjust methods and techniques this to the specific problem in relation to the project reflect on and, if relevant, further develop his/her work processes.

Cooperation competence:
- take part in a qualified dialogue about the project with other professionals and users.

Learning competence:
- learn and apply new theories, methods and techniques to the extent relevant for the project.

The student works with the final exam project as a project. The topic of the final exam project is formulated by the student in consultation with the educational institution and preferably also in cooperation with a company. The educational institution must approve the problem statement of report.

The students normally work with the exam project in groups of up to three people. The educational institution determines further details jointly with the individual student.

Conditions
The student must have passed all previous exams to be permitted to complete the final exam project. In addition, the educational institution must have given its acceptance of the internship.

Contents
The student formulates the problem statement for the final exam project in consultation with a company. The educational institution must approve the problem statement.

In his/her approach to the problem(s) defined it is essential that the student demonstrates his/her ability to apply core theories and methodologies.

The educational institution lays down the guidelines governing the formal requirements to the project.

3   Examination, tests and assessment

3.1   Conditions
The examinations are governed by
> Executive Order no. 714 of 27 June 2012 on Tests and Exams in Vocational Programmes (The Examination Order)

- Executive Order no. 262 of 20 March 2007 on the Grading Scale and Other Forms of Assessment
- Executive Order no. 702 of 3 July 2009 on the Academy Profession degree programme (AP) for Information Technology (AP Degree in Computer Science).

Reference is made to Retsinformation at **www.retsinfo.dk** (in Danish), where the latest versions of the Acts and Orders governing the area can be found at all times.

Each student must pass six exams, three of which – including the final project – are external exams and three are internal exams.

The student must pass all exams with a Pass or as a minimum with the mark 02.

The student is entitled to sit each exam three times. A student cannot re-sit an exam once it has been passed.

Exams must be carried out in Danish if the student has studied a programme in Danish. And in English if the student has studied an international programme. The educational institution may grant an exemption and allow a Danish student to sit the exam in Danish.

It is the student's own responsibility to stay informed about aspects of the exams.

For special examination provisions, cf section 17 of the Examination Order
When warranted by physical or mental impairment, students can apply for extra time for the examination or other arrangements for written exams held at the Academy. Applications must reach the Academy at the latest four weeks before the examination date. Exemptions from the date of application may be granted in the event of sudden health issues.

A medical certificate, a statement from for example a body dealing with speech, hearing or sight impairment, dyslexia, or other forms of documentation must be enclosed the application certifying serious health issues or specific relevant functional impairment.

3.2   Cancelling Registration
If the student does not want to sit an exam, the student must notify the office in writing as follows

- for project exams: at the latest 14 days prior to submission of the exam report
- for written exams: at the latest 14 days prior to the exam date
- for oral exams: at the latest 14 days prior to the exam date.

If a student cancels an exam, the student is registered for the next ordinary exam. This is not a re-exam.

If the student fails to cancel registration in time, the exam will count as an attempt, cf section 6 of the Examination Order. However, this does not apply if the student was prevented from sitting due to documented illness, cf section 7 (the section on illness) of the Examination Order.

A student cannot cancel those exam(s) which are scheduled to take place immediately following the courses and which are part of the 1st year of studies, according to the executive order/curriculum, since the student must sit these exams before the end of the 1st year of studies after having commenced the studies.

Re-examination due to illness
A student who was prevented from sitting an exam due to documented illness or other unforeseeable reasons is allowed re-examination as soon as possible. Is the exam scheduled for

the final exam period of the programme, the student will be given an opportunity to sit the exam within the same exam period or immediately after.

The re-exam can be identical with the next ordinary exam. It is up to the student to find out when the re-exam will take place. The student is automatically registered for the re-exam when this is due to illness.

Illness must be documented by a medical certificate. The educational institution must receive the medical certificate three workdays after the exam has taken place at the latest. A student who is taken acutely ill during an exam must document that he/she was ill on the day concerned.

If illness is not documented as laid down above, the student has used one attempt at sitting the exam.

The student must bear the expenses of the medical certificate.

Cancelling re-examination due to illness
A re-exam due to illness is cancelled according to the same rules as apply to cancellation of other exams. The educational institution may disregard the cancellation deadlines if unusual circumstance warrant this.

Duty to attend
In order to sit an exam the student must comply with the duty to attend, for example by

- submitting/presenting reports/projects and
- being physically present.

Details on the duty to attend can be found in the institution-specific part of the curriculum.

The educational institution may intervene and offer assistance and guidance at the earliest possible time if the student does not live up to his/her duty to attend.

Non-compliance with contents requirements

If the content of a written report and/or answer is not of a decent standard, or if the report and/or answer contains for example text, figures, tables, templates in which others have the copyright (plagiarism) without referring to this, cf the educational institution's provisions concerning written reports and answers, the written report and/or answer will be rejected on the grounds that the duty to attend and thereby the conditions laid down for the contents were not complied with.

Rejection of a report and/or an answer and non-compliance with formal requirements are also registered as non-attendance in an activity under the programme in the context of cancellation of registration with the educational institution and the student's receipt of SU (the national study grant). In such cases the student is deemed to have used one attempt at sitting the exam. Please refer to the rules concerning active participation in the institution-specific part.

3.3 Exams under the degree programme

The objective of the exams under the programme is to ensure that the standard of the programme and the passed educational elements are equivalent to similar educational elements at the other institutions offering the programme. Details about the organisation of the programme can be found in the institution-specific part of the curriculum and in descriptions of semesters etc. that apply to the individual business academies.

Details of the exams can be found under the respective semesters.

Semester	Exam	Internal/external	Duty to attend	Common/local	Assessment
2nd sem	First Year Exam Interdisciplinary oral project exam (project and report). Max 40 pages.	External	**10 activities during 1st year of studies**	Common	Mark
2nd sem	Programming exam (oral exam)	External	**3 activities**	Common	Mark
4th sem	Systems development exam (project exam) (oral exam)	Internal		Common	Mark
	Specialisation exam. Course work	Internal		Local	
5th sem	Internship (4-6 pages report)	Internal		Common	Pass/Fail
	Final exam project (project and report)	External		Common	Mark

Unless otherwise specifically stated, all exams are graded according to the 7-point grading scale.

For all project reports, a standard page is defined as 2,400 characters including spaces and footnotes. Front pages, tables of contents, literature lists and appendices are not included in the total number of standard pages. Appendices are not subject to assessment.

3.4 Exam, 2nd semester, 1st exam - 1st Year Exam

The exam covers all subjects taught in the 1st year of studies.

Form of examination: Project exam based on project work covering significant subject areas studied in the 1st year of studies.

The project totals 12 ECTS credits. The students work in project groups of three or four students applying the methods, techniques and tools they have been taught.

The exam verifies the learning objectives of the 1st and 2nd semesters. This includes that the student is able to

- communicate at a professional level to a target group
- enhance a system in service
- complete a project as a team effort.

External exam

The individual oral part of the exam focuses on the entire project.

Examination procedure:
1. Group presentation based on the product and the report: Maximum 30 minutes (Expected duration about 10 minutes for each student.)
2. Individual examination: 25 minutes
3. Evaluation and communication of grade: 5 minutes

Assessment Marks will be given individually based on a general assessment of the project and the oral performance during the examination.

The exam is scheduled for the end of the 1st year of studies.

Submission
The student submits a project report of maximum 40 standard pages, in addition to programs and the system in service.

Re-examination
Re-examination – individually or in the form of a group project. Normally, a new project and a new report have to be prepared. The Academy assesses whether the new project is to take its point of departure in the same problem as the project work that was used for the ordinary exam, or a new problem. The exam is held as the ordinary exam.

3.5 2nd Year Exam
One or more exams are held incorporating key parts of the core areas Programming and Systems Development, Technology and Specialisation. The educational institution lays down further rules for the exam(s).

Programming Exam (oral)
Scope of the exam: The subject area Programming and the subject Computer Networks and Distributed Systems.

The student picks a main question within the subject area Programming and a secondary question to the subject Computer Networks and Distributed Systems. The questions include both theoretical and practical elements. The student has 80 minutes to prepare his/her reply followed by the actual 40-minute examination including evaluation and awarding of marks. When evaluating the programming question is given an 80% weight.

Systems Development Exam – Internal (project)
Scope of the exam: The exam is based on a self-defined systems development project of an extent of 6 ECTS within set targets and frames. The oral exam is based on the entire subject area Systems Development. The project is performed in project groups typically consisting of 3-4 students. A project report of maximum 40 standard pages is handed in. The report is assessed individually which means that it must clearly appear from the report who is responsible for the individual parts. The individual oral part of the exam is based on the entire report.

Examination procedure:
The individual student gives a max. 10-minute presentation of selected parts of his/her project and then proceeds to the individual examination lasting 30 minutes including evaluation and awarding of marks.

Assessment: Marks will be given individually based on a general assessment of the written product and the oral performance in the examination.

Re-examination
Re-examination – individually or in the form of a group project. Normally, a new project and a new report have to be prepared. The Academy assesses whether the new project is to take its point of departure in the same problem as the project work that was used for the ordinary exam, or a new problem. The exam held as the ordinary exam.

3.6 Specialisation Exam (20 ECTS)
Details about the scope of the exam of the specialisation subject can be found in the institution-specific part.

3.7 Internship Exam – Internal (15 ECTS)
The test is an internal exam which evaluates the student's individual learning objectives, which the student has defined jointly with the host company and the Academy prior to the internship.

Internal Exam
The student's performance during the internship is evaluated in relation to the internship report. It is recommended that the student keeps a log during the internship which can later form the basis of the internship report.

The internship report must contain:
- A brief description of the host company/the company
- A description of the assignment(s)/question(s) and a reflection of these in relation to the theories the student was taught in the programme
- A reflection on the internship and the outcome.

Complete or partial result(s) of the assignment(s)/question(s) that the student has worked with can be enclosed in appendices to the report. The report must be between four and six pages.

Assessment
The performance is awarded a Pass or a Fail.

Re-examination
As for any other exam, the student is entitled to two re-examinations.

The grounds for re-examination are assessed in view of academic aspects:
- If the assessment resulted from lack of participation in the internship, a new internship is arranged.
- If the assessment resulted from lack of reflection in relation to the learning objectives, the student sits a new internship exam after about two weeks.

Re-examination due to illness
The student sits re-examination, if due to illness, as soon as possible and immediately before the start of the next semester at the latest.

3.8   Examination of Final Exam Project (15 ECTS)

The Final Exam Project is to document that the student is able to combine elements of theory, method and practice in a qualified manner and communicate these. In the final exam project the student must document that the above learning objectives have been fulfilled.

The problem to be addressed must be a core issue within IT and the student must formulate it jointly with a public or a private company to the extent possible. The problem is subject to the Academy's approval. The project results in a report and a product.

External exam

Oral exam based on project work, produced individually or in groups of up to four students. The exam of the final exam project comprises a project and an oral part. The student sits the exam at the end of the 5th semester.

Submission

The exam project is a report to be submitted to the educational institution together with a product, if any, in the number of copies and in the form that the educational institution has laid down in the institution-specific part. The report can total maximum 20 standard pages, plus 20 standard pages for each member of the group, excluding appendices. The product could be in the form of an application, a system, an analysis or a survey. For reports produced in groups, it must be stated clearly who produced which parts.

Number of students	Number of standard pages (of 2400 characters)
1 student	Max 40 standard pages
2 students	Max 60 standard pages
3 students	Max 80 standard pages
4 students	Max 100 standard pages

Re-examination

Re-examination – individually or in the form of a group project. Normally, a new project and a new report have to be prepared. The Academy assesses whether the new project is to take its point of departure in the same problem as the project work that was used for the ordinary exam or a new problem. The exam is carried out as the ordinary exam.

If several students complete the project together, the problem statement and the report should provide a more in-depth and thorough discussion of the topic. The report must include sections written by the individual student and sections written together.

Formal requirements

Spelling and formulation form part of the assessment of the final exam project. The mark expresses a general assessment of the academic contents and the student's ability to spell and use appropriate wording. Students who can document a relevant specific functional impairment can apply for an exemption from the requirement that spelling and wording are assessed. Such applications must be sent to the administration of the degree programme, for the attention of the head of the programme, four weeks before the student is to sit the exam at the latest.

Students can only sit the exam provided the contents of the report are of a decent standard. The report must fulfil the formal requirements and be submitted correctly and within the deadline. Further details can be found in the educational institution's guidelines on formal requirements in relation to the Computer Science Programme.

Examination
The report will form the basis of an oral, individual 30 minute examination.

1. Presentation of product and report: Maximum 10 minutes for each student
2. Individual examination based on the product and the report: 20 minutes.

Assessment
Marks will be given individually based on a general assessment of the product, report, individual performance at the presentation and individual examination.

Re-examination – individually or in the form of a group project
Normally, a new project and a new report have to be prepared. The Academy assesses whether the new project is to take its point of departure in the same problem as the project work that was used for the ordinary exam or a new problem.
The exam is carried out as the ordinary exam.

3.9 Examination in relation to paid stays abroad
When a student has been on a paid stay abroad via the educational institution, the student must document his/her learning at own educational institution. See appendix on examination in such cases. See the institution-specific part, if relevant.

3.10 Cheating offences in exams
When submitting a written answer and/or report etc. the student certifies by his/her signature (/upload to the institution's LMS) that the submitted answer and/or report etc. has been produced without undue assistance.

3.10.1 Using one's own work and that of others - plagiarism
Cheating in exams through plagiarism comprise instances where a written answer and/or report etc. is presented as if produced personally by the student(s), also if the answer and/or report

1. comprises identical or almost identical repetitions of the wording or work of others, without clearly identifying this using quotation marks, italics, indentation or other clear indications stating the source, cf the educational institution's requirements to written answers etc.

2. comprises major pieces of text with wording so close to that of another piece of writing or similar wording etc. that it is possible to determine through comparison that the text pieces could not have been written using any other sources

3. comprises the use of words or ideas of others without referencing these originators in an appropriate manner

4. re-uses text and/or core ideas from the student's own previously assessed answers (self-plagiarism) etc. without observing the provisions laid down in item 1 and 3.

3.10.2 Disciplinary procedures for dealing with cheating offences and disruptive behaviour in exams

During exams

A student who sits an exam and who beyond doubt during this exam

- receives unauthorised help or
- helps another student answer a question at the exam or
- uses unauthorised materials and aids

and a student who during this exam

- exhibits disruptive behaviour

can be expelled from the exam by the head of the degree programme or whoever the head of the degree programme authorises to do so, or the examiners can agree to expel the student from the exam while taking place. In such cases the justification of the action is evaluated in connection with the subsequent decision.

If the disruptive behaviour is less serious, the educational institution will initially issue a warning.

Presumed cheating at an exam, including plagiarism during and after the exam

If during or after an exam there is the presumption that a student

- has received or given unauthorised help,
- has presented the work of another person as his/her own or
- has used his/her own previously assessed work or parts thereof without referring to it (plagiarism)

this will be reported to the administration of the degree programme.

3.10.3 Investigation of cheating offences in exams, including plagiarism

Postponement of the exam

If the cheating concerns plagiarism in a written report and/or answer which is used in the assessment of a subsequent oral exam, the head of the degree programme postpones the exam, if the issue cannot be resolved before the date set for the exam. If relevant, the head of the degree programme can choose to complete the exam with the purpose of revealing cheating in the exam.

Form and content of the report

Reporting must be made without undue delay. The report must be accompanied by a written description of the breach, comprising information that can identify the individuals reported on in addition to a brief summary and the documentation substantiating the matter. In the event of repeated offences, involving one or more people, this must be stated.

When reporting on plagiarism, the plagiarised parts must be marked with clear reference to the sources of the plagiarised content. Similarly, the plagiarised text must be marked in the source text.

Involving the student – hearing of the party(-ies)

The head of the degree programme decides whether the hearing of the student should be oral, in writing or a combination thereof.

For the oral hearing, the student is summoned to an interview with the purpose of clarifying the matter in order to present the documentation substantiating the presumed cheating in the exam to the student and to hear his/her point of view. The student has the right to accompanied by a person of his/her own choice.

For the written hearing, the documentation substantiating the presumed cheating in the exam is forwarded in order to ask the student to make a written statement of his/her point of view.

3.10.4   Penalties for cheating offences and disruptive behaviour during exams

If the clarification of matter confirms the presumed cheating offence to the head of the degree programme and the action has had or would have had affected the assessment, the head of the degree programme expels the student from the exam.

Under aggravating circumstances, the head of the degree programme can expel the student for long or short periods of time. In such cases the student receives a written warning to the effect that repeat offences may lead to permanent expulsion.

Expulsion according to the above terms will lead to cancellation of any marks that may have been granted for the exam concerned, and the exam will count as one attempt.

The student cannot sit a re-examination and cannot sit the exam until the exam is scheduled on ordinary terms as part of the degree programme. If special circumstances speak in favour of this, the educational institution may grant an exemption and allow the student to sit a re-examination.

Under aggravating circumstances, the head of the degree programme may decide to expel the student from the educational institution for a short or long period of time. In such cases the student receives a written warning to the effect that repeat offences may lead to permanent expulsion.

During a period of expulsion the student may not attend classes or exams.

3.11 Appeal

The decisions that an attempt at the exam has been used and expulsion due to a cheating offence at an exam are final and cannot be appealed to a higher administrative authority.

Appeals concerning legal aspects (such as incapacity, hearing, appeal instructions, correct or incorrect interpretation of the Examination Order etc.) can be brought before the Danish Agency for Higher Education and Educational Support. The complaint is forwarded to the educational institution, for the attention of the head of the degree programme. The head makes a statement which the appellant must be given an opportunity to comment on, normally one week. The educational institution forwards the appeal, the statement and any comments that the appellant may have made to the Danish Agency for Higher Education and Educational Support. Appeals must reach the educational institution no later than two weeks from the day that the appellant was notified of the decision, cf section 50 of the Examination Order.

3.11.1   Complaints about exams and appealing decisions

Complaints about exams

The student is recommended to ask the tutor for guidance on appeal procedures and how to prepare an appeal.

The rules governing complaints concerning exams can be found in chapter 10 of the Examination Order.

The Examination Order differentiates between complaints concerning
1. the scope of the examination etc., the examination procedure and/or the assessment and
2. complaints about legal matters.

The two types of complaints are treated differently.

Complaints about the scope of the examination etc., the examination procedure and the assessment
A student can submit a written complaint, stating his/her reasons, within two weeks after the assessment has been communicated in the usual way, concerning:

1. the scope of the examination, including questions asked, work submitted etc., and the exam relative to the objectives and demands of the programme
2. the examination procedure
3. the assessment.

The complaint may concern all exams, including written, oral and combinations thereof, and practical or clinical exams.

The complaint is sent for the attention of the head of the degree programme.

The original examiners, ie, the internal examiner and the external examiner of the exam concerned, must be presented with the complaint immediately. The educational institution must be able to form its decision in relation to academic issues based on the statement from the examiners. Normally, the educational institution allows two weeks to make the statements.

Immediately when the examiners' statement is available, the complainant is given an opportunity to comment on the statements, normally within one week.

The educational institution makes decisions regarding complaints based on the academic opinion presented by the examiners and the complainant's comments on the opinion.

The decision, which must be in writing, stating reasons, can be as follows:
1. an offer for a new assessment (re-assessment) – although only written exams
2. an offer for a new exam (re-examination)
3. the decision is not in favour of the student.

If the decision is to offer re-assessment or re-examination, the head of the degree programme appoints a review panel. Re-assessment applies only to written exams where material is available for assessment, partly because the review panel cannot make a (re-)assessment of an oral exam that has already been held and because the notes made by the original examiners are personal and cannot be divulged.

If the decision is to offer re-assessment or re-examination, the complainant must be told that re-assessment or re-examination may lead to a lower mark. Within a period of two weeks after the decision has been communicated, the student must accept the offer. Acceptance cannot be cancelled. If the student does not accept within this period of time, there will be no re-assessment or re-examination.

Re-assessments or re-examinations must take place as soon as possible.

For re-assessments the documentation of the matter must be made available to the review panel, viz the assignment and/or the questions, the answer(s), the complaint, the statements made by the original examiners with the complainant's comments and the educational institution's decisions.

The review panel notifies the educational institution of the outcome of the re-assessment and encloses a written statement with the reasons and the actual assessment. Re-assessments or re-examinations may produce lower marks.

If the decision is to offer re-assessment or re-examination, this decision applies to all students if the exam suffers from the same defects as those referred to in the complaint.

The complaint is sent to the head of the degree programme two weeks (14 calendar days) at the latest after the assessment of the exam concerned has been communicated. If the due date is on a public holiday, the due date will be the first workday following the public holiday.

Exemptions from the deadline can be made in the event of unusual circumstances.

3.11.2   Appeal

As regards academic issues, the complainant can submit the educational institution's decision to an appeals panel. The activities of the appeal panel are governed by the Public Administrations Act, this also includes incapacity and confidentiality.

The appeal is sent to the head of the degree programme.

Appeals must be submitted two weeks at the latest after the decision has been communicated to the student. The requirements as above for complaints (in writing, stating reasons etc.) also apply to appeals.

The appeal panel consists of two authorised external examiners, who are appointed by the chairman of the external examiners, a lecturer authorised to conduct examinations and a student studying the subject area (the degree programme), both of which are appointed by the head of the degree programme.

The appeal panel makes decisions based on the material that the educational institution used for its decision and the student's appeal, with reasons stated.

The appeal panel considers the appeal and the decision may result in:
1) an offer for re-assessment by new reviewers, although only written exams
2) an offer for a new exam (re-examination) by new examiners
3) the decision is not in favour of the student.

If the decision is to offer re-assessment or re-examination, the complainant must be told that re-assessment or re-examination may lead to a lower mark. Within a period of two weeks after the decision has been communicated, the student must accept the offer. Acceptance cannot be cancelled.

If the student does not accept within this period of time, there will be no re-assessment or re-examination.

Re-assessments or re-examinations must take place as soon as possible.

For re-assessments the documentation of the matter must be made available to the review panel, viz the assignment and/or the questions, the answer(s), the complaint, the statements made by the original examiners with the complainant's comments and the educational institution's decisions.

The appeal panel must reach a decision at the latest two months – for summer exams three months – after the appeal has been submitted.

Decisions of the appeal panel are final. This means that the matter cannot be brought before a higher administrative authority as regards the academic aspects of the appeal.

3.11.3   Complaints about legal matters

Complaints about legal aspects of decisions made by the review panel in connection with reassessments or re-examinations or about decisions of the appeal panel can be brought before the educational institution. The deadline for submitting of complaints is two weeks from the day the decision has been communicated to complainant.

Complaints about legal aspects of decisions made by the educational institution pursuant to the rules laid down by the Examination Order (such as incapacity, hearing, correct or incorrect interpretation of the Examination Order etc.) can be submitted to the educational institution. The educational institution issues a statement and the complainant must given normally one week for commenting. The educational institution forwards the complaint, the statement and any comments that the complainant may have made to the Danish Agency for Higher Education and Educational Support. Complainants must be submitted to the educational institution at the latest two weeks (14 calendar days) after the day when the decision was communicated to the complainant.

4   Exemptions

When special conditions warrant it, the educational institution can grant an exemption from the rules in the curriculum which the educational institution concerned or the other educational institutions have laid down in the curriculum on their own accord.

5   Credit Transfer

The educational institution can accept that passed educational elements or parts thereof, according to this curriculum, passed at another institution are equivalent to educational elements or parts thereof in this curriculum. If the educational element in question is assessed according to the 7-point grading scale at the institution where the student sat for the exam and corresponds to an entire subject in this curriculum, the mark is transferred.

The educational institution can accept that passed educational elements from another Danish or foreign tertiary programme substitute educational elements included in this curriculum. On acceptance the educational element is considered completed if it is passed according to the rules for the programme in question. The assessment is transferred as a Pass.

6   Admission to top-up programmes

Direct access to the following top-up programmes is provided:

- Professional Bachelor's degree in Software Development
- Professional Bachelor's degree in Web Development
- Professional Bachelor's degree in E-Concept Development

Parts of the programme are accredited at certain educational institutions, for example the Bachelor degree programmes of Computer Science, Software, Informatics or Information Technology at Aalborg University and at the Esbjerg Department of Aalborg University. Further information can be found at the university's website.

Furthermore the programme opens for the opportunity to obtain a bachelor degree abroad via further studies of typically 1-2 years' duration.

7   Effective date

This curriculum is effective for students who initiate their studies in August 2013.

8   Leave of Absence

A student may be granted leave of absence from the programme due to personal circumstances. Further rules about leave of absence as well as rules applying to students on leave can be found in the Academy's guidelines.

9   The Programme Is Governed by the Following Acts and Orders

- Consolidated Act no. 467 of 8 May 2013 on executive Order on the Act on Academy Profession and Professional Bachelor Degree Programmes
- Executive Order no. 636 of 29 June 2009 on Academy Profession and Professional Bachelor Degree Programmes
- Executive Order no. 702 of 3 July 2009 on the Academy Profession Degree Programme (AP) in Information Technology (AP Degree in Computer Science).
- Executive Order no. 1146 of 1 October 2010 on Quality Assurance of Vocational Higher Education Programmes
- Executive Order no. 210 of 1 March 2013 on Admission to Academy Profession and Professional Bachelor Degree Programmes
- Executive Order no. 262 o 20 March 2007 on the Grading Scale and Other Forms of Assessment
- Executive Order no. 952 of 2 October 2009 on the Act on Open Education (Vocational Adult Education) etc.
- Executive Order no. 714 of 27 June 2012 on Tests and Exams in Vocational Programmes (The Examination Order).

The Act and the Executive Orders are available in Danish at the website www.retsinfo.dk.

Part 2: Institution-specific part

10   Rules governing the internship

During the internship, the student is supported by an internship tutor from the programme and a contact person within the company. The company and the student jointly define the objectives for the student's learning outcome from the internship, and subsequently these serve as guidelines for the company's organisation of the student's work.

The internship concludes with an exam. See section 3 for a description of the exams in the degree programme.

Generally, the internship is equivalent to a standard job as regards required performance, commitment and versatility that a fully trained computer scientist must be expected to meet in his/her first job.

11   Internationalization

The way the degree programme is structured, the student can study the electives in the 4th semester abroad and likewise international students can study a semester of the programme.

Similarly, the internship can take place abroad.

The options are also good if the student wants to study one or more electives as a summer school abroad.

Contact the international office for further details about specific options.

11.1 Examinations when studying the 4th semester abroad

The student must sit his/her exams at the partner institution abroad. The student must also document the learning outcome from the subjects studied at the partner institution online in a portfolio. The student writes a report for each subject describing the learning outcome of the subject.

The report must have an extent appropriate for the points awarded for the subject(s), although minimum three standard pages of 2400 characters for each page.

All assignment and their answers must be documented online in the portfolio. Links to the portfolio and the documentation substantiating exam(s) passed at the partner institution must be submitted to the Academy at the latest four weeks after the exams abroad have been taken. The portfolio, including the reports on the learning outcome, is given a Pass or a Fail.

The Academy awards 20 ECTS credits from the 4th semester in the form of specialisation with a separate exam in order to provide students with optimum opportunities to organise studies abroad. Further details can be found in the section "Elective element: Specialisation".

12 Ways of teaching and working

The tuition given at the Computer Science programme is a dynamic, interactive process with the main emphasis on active participation by the students. The tuition is based on relevant business practices and combines practice and theory. Relevant problems from different types of companies in the IT industry are included. The students must be responsible for own learning and both students and lecturers alike contribute constructively to the learning process.

In order to ensure optimum academic learning and personal development in each student, the Computer Science programme applies various pedagogical approaches, with the main emphasis on dialogue, discussion and project work.

The tuition is given a variable structure and offers lessons in class, guest lecturers, company visits, project work in groups and individualised work – often in an interdisciplinary context and always focusing on the usability aspect. In addition to academic skills, the different ways of learning help the students develop their abilities to work on their own and together with others.

Common to all of these activities, we always strive to define (or help to define) clear objectives for the learning.

The tuition can be organised to include foreign languages in the form of educational material and the actual tuition.

13 Rules about the student's duty to attend tuition and requirements to written assignments and projects

13.1 The student's duty to attend tuition
Studying for a degree at Business Academy Aarhus is comparable to being in the labour market. Like any other place of work, the students must therefore attend all scheduled tuition and any other study activities. Absence is noted – and in the event of excessive absence, the student will be summoned for an interview to discuss this in order to reduce the absence as fast as possible.

If a student is unable to attend tuition one day due to illness, the student is expected to notify the lecturer and the team leader about it stating the reason(s) why. Absence due to illness is, however, included in the total count of absence.

If the student's absence on average exceeds 20%, the SU payable to the student may be cancelled. The student will be given notice about this.

13.2 Compulsory assignments
Answers to compulsory assignments must be submitted by the student in order to be considered an active student. If the assignment involves an oral presentation, the student has the duty to meet for this.

Compulsory assignments are not considered tests or exams, they are part of the learning process and document that the student is actively studying.

The 1st year of studies comprises the following compulsory assignments:

- BU 1 – 1 answer to be submitted
- BU 2 – 1 answer to be submitted
- CAOS – 1 answer to be submitted
- SD 1—1 answer to be submitted + 2 project common with SK 1
- SD 2 – 1 project common with SK 2
- SC 1 – 1 answer to be submitted + 2 projects + 2 project common with SD 1
- SC 2 – 1 project common with SD 2
- The internal exam following the 1ˢᵗ semester.

In special cases the Academy may grant exemptions from this.

The compulsory assignments are described in the subject descriptions of the individual semesters, to be found on Fronter.

13.3 Elective: Specialisation (20 ECTS)

The specialisation gives the student an opportunity to enhance his/her academic and professional competence by specialising and putting themes into perspective within the wider scope of information technology.

The Academy organises the specialisation by identifying and offering a series of specialisation courses within the objective of the degree program. In this connection the Academy takes the needs of the local business community into consideration as well as student wishes and current trends. Up-to-date descriptions of the specific specialisation courses can be found on Fronter.

Examination is an internal exam in the form of individual course work comprising the full scope of the specialisation. The student submits a report of max. 25 standard pages. The report is assessed by an examiner and a mark is given according to the 7-point grading scale.

13.4 Guidelines for the Internship

During the internship, the student is supported by an internship tutor from the programme and a contact person/tutor within the company.

Based on the learning objectives for the internship, the student defines together with the tutors/contact person the objectives for the student's learning outcome from the internship. This forms the subsequent guidelines for how the student's work is structured in the internship.

The internship is intended to be equivalent to a full-time job with the same the requirements in terms of working hours, performance, involvement and versatility that a fully trained computer scientist must be expected to meet in his/her first job.

The student is entitled to SU during the internship, and only the student and the host company agree on the financial terms for the internship.

Further details can be found in the document **"Retningslinjer for praktik på Datamatikeruddannelsen"** (in Danish). The document is accessible on Fronter under "Info til alle DMU-studerende".

Rules on completion of the internship and the internship exam can be found in section 3.7.

13.5 Guidelines for the Final Exam Project

The student works with the final exam project as a project. The topic of the final exam project is formulated by the student in consultation with the Academy and preferably also in cooperation with a company. The Academy must approve the wording of report.

Normally the Academy appoints a tutor. The report is submitted and the student sits the exam as described for external exams.

The exam in the final exam project comprises assessment of the documented deliverables as part of the Project and an oral defence. The student is given one mark; the primary purpose of the defence is to ensure that the deliverables were in fact produced by the student and secondly for minor adjustments in the assessment of the student's qualifications.

The final exam project takes the form of a report and a product, if relevant, to be submitted to the Academy in three copies. As regards the number of pages etc., see section 3.8 about the exam in the final exam project and the memo issued by the Academy concerning the final exam project at the degree programme in Computer Science ("Afsluttende eksamensprojekt" - available in Danish).

14 Quality Assurance

The quality of the degree programme is assured as provided by

- Act on Accreditation of Higher Education Institutions (Consolidated Act no. 601 of 12 June 2013)

- Executive Order on Special Conditions for Approval of Academy Profession Degree Programmes, Professional Bachelor Degree Programmes, Academy Profession Degree Programmes and Diploma Programmes (Executive Order no. 746 of 24 June 2013)

- Executive Order on the Accreditation of Higher Educational Institutions and Approval of New Higher Educational Programmes (Executive Order no. 745 of 24 June 2013).

15 Effective date

The curriculum is effective for students who initiate their studies by 1 August 2013.

16 Studies Abroad and Transfer of Credits

The Academy assists the student in finding degree programmes offered by bodies abroad with learning objective equivalent to those of the degree programme in Computer Science. Also the internship can take place abroad.

The Academy can accept that passed educational elements or parts thereof, according to this curriculum, passed at another institution are equivalent to educational elements or parts thereof in this curriculum. If the educational element in question is assessed according to the 7-point grading scale at the institution where the student sat the exam and corresponds to an entire subject in this curriculum, the mark is transferred.

The Academy can accept that passed educational elements from another Danish or foreign tertiary programme substitute educational elements included in this curriculum. On acceptance, the

educational element is considered completed if it is passed according to the rules for the programme in question. The assessment is transferred as a Pass.

17 Exemptions from the Curriculum

When warranted by special circumstances, the Academy can grant an exemption from the regulations of the curriculum when these regulations are not founded on statutory provisions.

18 Complaints

Complaints about decisions made in compliance with this curriculum must be submitted to the Academy. Complaints must be submitted within two weeks from the day when the decision was communicated to the student.

The student can bring decisions made by the Academy in compliance with this curriculum for the Ministry of Education when the complaint concerns legal aspects. Complaints must be submitted within two weeks from the day when the decision was communicated to the student.

The complaint is for the attention of the Ministry of Education but submitted to the Academy. The Academy makes a statement which the complainant is given an opportunity to comment on, within one work week. The Academy then sends the complaint, the Academy's statement and any comments from the complainant to the Ministry of Education.

Part 3: Appendix

19 Appendix 1: Learning objectives for the programme's core areas

19.1 Programming (40 ECTS)

The subject Programming comprises the following learning objectives:

Learning objectives
Knowledge
   The objective is that the student

- understands the qualitative and quantitative properties of algorithms
- knows about classic data structures, including their qualitative and quantitative properties
- understands specifications of abstract data types
- is familiar with program quality criteria
- knows about descriptions of the syntax and semantics of formal languages
- is familiar with abstraction mechanisms in modern programming languages

Skills
   The objective is that the student

- can specify and construct algorithms

- can use fundamental algorithm templates and programming techniques
- can employ central design patterns
- can choose appropriate data structures to realise abstract data types
- can use abstract data types to realise programs
- can use the language to realise algorithms, templates, patterns, abstractions and data structures
- can use programming languages to realise design models
- can use program libraries associated with programming languages
- can use programming languages and associated program libraries to realise user interfaces
- can use a development environment associated with a programming language
- can use means and tools to achieve quality programs
- can realise models in a database system
- can structure programs that use a database interface
- can use the data definition language and data manipulation language of a database system
- can design and structure programs in the form of interrelated processes/threads
- can use techniques to structure programs with several simultaneous users
- can design and structure programs based on interrelated processes in a distributed architecture
- can structure programs that use modern network technologies
- can use patterns for software architecture, including frameworks
- can use and develop software components

Competences

The objective is that the student

- can be part of development/maintenance projects as a competent programmer
- can keep up-to-date with current programming languages and development tools
- can learn new programming techniques and program designs.

19.2 System Development (25 ECTS)

The subject Systems Development comprises the following learning objectives:

Learning objectives

Knowledge

The objective is that the student

- understands the importance of modelling in connection with system development
- understands component-based development
- has acquired an understanding of systems development methods
- understands the characteristics of a project organisation
- has acquired an understanding of several different process models for project work
- understands the relevance of experimenting as part of or as supplement to systems development methods
- understands the importance of quality criteria to the system development process and the final system design

Skills

> The objective is that the student

- can use tools and techniques to structure relevant models
- can develop models on the basis of patterns
- can choose and/or adapt a method according to the situation
- can use a current system development method
- can use techniques to incorporate users in systems development processes
- can analyse the system development domain in order to understand the commercial and technological conditions and specify requirements
- can develop designs of appropriate IT systems and set up and differentiate between various draft solutions in relation to specifications and conditions
- can develop a design of a general architecture for centralised and distributed systems
- can develop user interface designs
- can develop database designs
- can organise and manage small development projects
- can detail a project strategy in order to choose and/or adapt a process model according to the situation
- can use IT tools to support activities in a system development process
- can use experiments for systematic identification of user requirements
- can use experiments for systematic investigation of technological options and limitations
- can ensure the quality of product and process

Competences

> The objective is that the student

- can be a competent member of a development project
- can reflect on his/her own practices as regards method and process
- can adapt and combine the process models and systems development methods of a project according to the situation
- can follow the technological progress and constantly learn about new process models and systems development methods

19.3 Technology (20 ECTS)

The subject Technology comprises the following learning objectives:

Learning objectives

Knowledge

> The objective is that the student

- knows about memory management and its importance to the running of the program
- knows about the facilities of modern file systems
- understands the organisation and running of processes and threads
- knows about the structure of computers and operative systems

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- knows how the underlying layer supports structures in the programming language chosen
- knows about the principles of structuring failsafe systems
- understands core security-related concepts, including authorisation, authentication, encryption and logging
- understands core threats of a technical nature that an IT system may be exposed to and understands how to prevent these threats
- understands the principles of designing and realising distributed systems
- understands the techniques used to integrate non-homogeneous systems
- understands the functionality of various types of standard servers, including web servers and application servers
- understands a layered communication model
- understands addressing in network environments
- knows about types of networks and network components
- understands the facilities and operation of a modern database server, including transaction management
- understands how database servers manage queries
- knows about the technological development, including development trends

Skills
    The objective is that the student

- can use mechanisms to synchronise threads
- can use standard components for secure communication
- can use standard application protocols to structure distributed systems
- can analyse system architectures and choose between the draft solutions of a given assignment
- can use the services offered by the different types of standard servers, including web servers and application servers
- can use a programming interface for communication networks

Competences
    The objective is that the student

- can use fundamental technological knowledge for the purpose of systems development and programming
- can follow the progress within this technological field and understands how this progress affects systems development and programming

19.4 Business Understanding (15 ECTS)
The subject Business Understanding comprises the following learning objectives:

Learning objectives

Knowledge
    The objective is that the student

- understands organisational structures and the factors that determine the structure of the organisation
- understands the company's management and business processes
- understands management approaches, including project management and group behaviour in organisations
- understands organisational change processes in connection with the implementation of new IT tools
- understands the innovation process
- understands various e-business models
- understands the importance of business strategies and IT strategies to the company's IT systems
- knows about financial concepts as well as principles and methods for recording management information
- knows about the characteristics, structure and operation of ERP systems
- understands how the ERP systems is linked to the company's central processes and external relations
- understands the procedures used to implement IT systems
- knows about the importance of the organisational structure for IT security
- is familiar with risk assessment and vulnerability assessment processes.

Skills
The objective is that the student
- can put a company's need for IT systems into words
- can prepare a Business Case
- can analyse and describe a company's business areas and business procedures
- can participate in the development of visions for new IT solutions
- can lay down an IT strategy, including how it relates to e-business concepts based on a business strategy
- can participate in the development of cost-benefit analyses and investment calculations
- can participate in the development of budgets and financial analyses
- can specify the scope of an ERP system and make company-specific adjustments
- can use models to describe a company's systems
- can describe the consequences of IT procurement
- can analyse a company's IT security system

Competences
The objective is that the student

- can follow the technological progress and understands how this progress can affect and be exploited by a company
- knows his/her way around different types of organisations
- is capable of contributing to understanding the business according to the situation in relation to procurement, development and implementation of IT systems
- includes relevant commercial aspects in connection with both strategic and routine decisions in relation to the development and use of IT systems

19.5 Themes and Distribution of ECTS Credits onto the Core Areas of the Degree Programme

Programming	Systems Development	Technology	Business Understanding
40 ECTS	**25 ECTS**	**20 ECTS**	**15 ECTS**
Contents described through themes: - Algorithms - Templates, techniques and patterns - Data structures and abstract data types - Programming languages - Program quality - Language theory - Database programming - Synchronisation - Distributed programming - Software architecture	Contents described through themes: - Modelling - Method - Analysis - Designs - Project work - IT tools - Experiments - Quality	Contents described through themes: - Operating systems - Security - Distributed systems - Networks - Databases - Technology development	Contents described through themes: - Organisational and commercial understanding - Business analysis - IT and business concepts - Financial management - ERP systems - IT procurement - Organisation and IT security