

Software Development

Curriculum 2020



**ERHVERVS
AKADEMI
SYDVEST**

Bachelor in Software Development

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This curriculum is based on:

- Ministerial order no. 1500 of 02.12.16 or newer version (Examination order)
- Ministerial order no. 858 of 22.08.19 or newer version (Academy profession programmes and Professional Bachelor Programmes)
- Ministerial order no. 790 of 09.08.19 or newer version

1 Exams in general

Time Frame	Educational Element	ECTS credits	Internal/External exam	National/Local educational element	Evaluation
1 st year	Developing Large Systems	10	External	National	7 - point grading scale
1 st year	Databases for Developers	10	Internal	National	7 - point grading scale
1 st year	System Integration	10	External	National	7 - point grading scale
1 st year	Testing	10	Internal	National	7 - point grading scale
1 st year	Local Educational elements (electives)	20	Internal	Local	7 - point grading scale
2 nd year	Internship	15	Internal	National	7 - point grading scale
2 nd year	Bachelor final project	15	External	National	7 - point grading scale

Overview of examinations and time frame:

Information about time and place for the examinations will be posted on EASV's LMS.

Joining the semester, the education element, etc. is also a registration for the corresponding exams.

Deregistration from an exam is only possible in special circumstances such as illness (documented with a medical certificate), death in the family or exceptional circumstances that influences the students well being. Deregistration shall be provided to the cluster manager before the beginning of the exam or as soon as possible. Documentation in writing needs to be submitted before the attempt can be cancelled, cf. section 11.

2 Scope and criteria for examinations

The programme consists of the following national educational elements:

- Developing Large Systems (10 ECTS)
- Databases for Developers (10 ECTS)
- System Integration (10 ECTS)
- Testing (10 ECTS)

Learning goals, ECTS scope, content and number of examinations for the national educational elements have been determined collaboratively by the institutions of higher education offering the study programme.

The national educational elements for the programme consist of study activities corresponding to 40 ECTS, and consist of the elements listed below.

2.1 Developing Large Systems

Developing Large Systems
Timing: 1 st year of study
Scope: 10 ECTS
Content: The aim of the subject element is to train the student to develop large- scale IT systems, where scalability is a key characteristic. The student must have knowledge of how key system development methods handle issues related to scalability and the development of large distributed systems. The student must have Knowledge of concepts, techniques and technologies for the continuous integration and delivery of software-based systems. The student must be able to design, implement and maintain large distributed systems in distributed development teams.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Issues related to the development of distributed and large-scale ITsystems, and how disciplined and agile development methods prescribe how these issues should be handled• The advantages, disadvantages and costs of using a system for the continuous integration and delivery of IT systems• Quality criteria for the design of interfaces to subsystems• Configuration and error reporting systems dedicated to the development of large distributed systems <i>Skills</i> The student can: <ul style="list-style-type: none">• Apply techniques for dividing a system into subsystems• Design and specify requirements for subsystems• Use version control systems dedicated to the development of large distributed systems in a distributed development team• Use a system for continuous integration and delivery

Use architecture patterns dedicated to the development of large distributed systems
<i>Competencies</i> The student can: <ul style="list-style-type: none">• Cooperate in large systems development organizations• Participate in globally distributed development• Adapt development methods and processes to the development of large distributed systems.
The examination: This examination is an individual external oral exam. The exam lasts for 30 minutes including assessment.
Assessment: 7 point grading scale

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are compulsory participation requirements that must be met in order to be qualified to do the exam. These requirements are described in the course plan for each course. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of academic activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the consequences of lack of participation are made by the student counselor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

2.2 Database for Developers

Databases for Developers
Timing: 1 st year of study
Scope: 10 ECTS
Content: The aim of the subject element is to train the student to be able to select and apply various database types appropriately in relation to various fields of application. The student must also be able to analyze and develop in relation to large databases, including redesign and optimization.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Various database types and the underlying models• A specific database system’s storage organization and query execution• A specific database system’s optimization possibilities – including advantages and disadvantages• Database-specific security problems and their solutions• Concepts and issues in relation to data warehousing, including big data

- The particular issues raised by having many simultaneous transactions, including in connection with distributed databases
- Relational algebra (including its relationship to execution plans)

Skills

The student can:

- Transform logical data models into physical models in various database types
- Implement database optimization
- Use parts of the administration tool to assist in the optimization and tuning of existing databases, including the incorporation of a specific DBMS' execution plans
- Use a specific database system's tools for handling simultaneous transactions
- Use the programming and other facilities provided by a modern DBMS
- Use an object-relational mapping tool

Competencies

The student can:

- Analyze the application domain in order to select a database type
- Divide responsibility for tasks between the application and DBMS during system development, to ensure the best possible implementation.

The examination:

This examination is an individual internal oral exam. The exam lasts for 20 minutes including assessment.

Assessment:

7 point grading scale

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are compulsory participation requirements that must be met in order to be qualified to do the exam. These requirements are described in the course plan for each course. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of academic activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the consequences of lack of participation are made by the student counselor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

2.3 System Integration

System Integration

Timing: 1st year of study

Scope: 10 ECTS
Content: This subject element must help ensure that the student develops the competencies to be able to work with technical system integration. After completing this module, the student must be able to integrate existing systems in connection with the development of new systems, and develop new systems supporting future integration.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Business considerations in relation to system integration• Standards and standards organizations• Storage, transformation and integration of data sources• The concept of services and their ties to service-oriented architectures• Technologies which can be used to implement a service-oriented architecture• Tools for integration <i>Skills</i> The student can: <ul style="list-style-type: none">• Use an object-oriented system in a service-oriented architecture• Design a system that is easy to integrate with other systems, and uses existing services• Transform or expand a system so that it can function in a service-oriented architecture• Use patterns that support system integration• Integrate generic and other systems• Choose from various integration methods• Translate elements in a business strategy into specific requirements for system integration <i>Competencies</i> The student can: <ul style="list-style-type: none">• Choose from various integration techniques• Acquire knowledge of developments in standards for integration• Adapt IT architecture to take into account future system integration.
The examination: This examination is an individual external oral exam. The exam lasts for 30 minutes including assessment.
Assessment: 7 point grading scale

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are compulsory participation requirements that must be met in order to be qualified to do the exam. These requirements are described in the course plan for each

course. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of academic activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the consequences of lack of participation are made by the student counsellor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

2.4 Testing

Testing
Timing: 1 st year of study
Scope: 10 ECTS
Content: The aim of the subject element is to train students in planning and conducting testing. The student must understand the place and significance of testing in methods for system development. The student must be able to design and carry out systematic testing for large systems, including the establishment of automated testing. The student must also master concepts and techniques for the design and construction of testable systems.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Significant test strategies and models and their role in system development• Testing as an integral part of a development project• Various types of testing and their applications <i>Skills</i> The student can: <ul style="list-style-type: none">• Ensure traceability between system requirements and testing at all levels• Apply both black-box and white-box testing techniques• Apply various criteria for the degree of test coverage• Use techniques for verification and validation• Use techniques and tools for automated testing• Build systems to manage testing and the fault rectification process in development projects <i>Competencies</i> The student can: <ul style="list-style-type: none">• Define, plan and carry out testing in a development project that matches the project's quality requirements• Plan and manage the implementation of internal and external testing of software systems.• Design testable systems
The examination: This examination is an individual internal oral exam. The exam lasts for 20 minutes including assessment.
Assessment: 7 point grading scale

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are compulsory participation requirements that must be met in order to be qualified to do the exam. These requirements are described in the course plan for each course. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of academic activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the consequences of lack of participation are made by the student counselor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

3 Local educational elements (electives)

In addition to the national educational elements, the programme consists of a number of local educational elements (electives) corresponding to 20 ECTS in total.

The specific learning objectives for each local educational elements are described in the appendix.

4 Internship

The Bachelor's Degree programme in Software Development includes both theory and practical experience with the purpose of supporting the students' continuous learning process and contributing to the fulfillment of the learning objectives specified for the study programme. During the internship, students are faced with professionally relevant issues, and become familiarized with relevant job functions. The student actively and independently seeks a placement with one or more private or public companies, and EASV ensures that the internship settings are satisfactory.

The internship can be compared to a full-time job, with demands regarding working hours, work to be done, involvement and flexibility that correspond to those that a graduate can expect to meet in his/her first job.

The internship is unpaid.

Internship
Timing: 3 rd semester
Scope: 15 ECTS
Purpose: The internship is organized so that it contributes – in combination with the rest of the study programme – to the student developing practical competencies. The aim of the internship is to enable the student to apply the programme’s methods, theories and tools by performing specific practical software development tasks.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Daily operations throughout the internship company <i>Skills</i> The student can: <ul style="list-style-type: none">• Apply versatile technical and analytical working methods linked to employment within the profession• Evaluate practice-oriented issues and identify possible solutions• Manage the structuring and planning of day-to-tasks within the profession• Communicate practice-oriented issues and reasoned solution proposals <i>Competencies</i> The student can: <ul style="list-style-type: none">• Handle development-oriented, practical and professional situations in relation to the profession.• Acquire new knowledge, skills and competencies related to the profession• Participate in academic and interdisciplinary collaboration with a professional approach.
The examination: This examination is an individual internal exam based on the internship report. The following internship report requirements apply: <ul style="list-style-type: none">• Front page with student name, internship company, and internship period• Introduction, including main issues, problem statement and approaches• Reflection of the learning outcome• Description of specific jobs done during the internship• Conclusion• Appendix: Statement from the internship company and the students diary/internship log• Bibliography (including all sources referred to in the report)• Other Appendices (including only those documents that are central to the report) The maximum number of pages for the internship report is 10 standard pages. A standard page is defined as 2400 characters, including spaces and footnotes, but excluding the front page, table of contents, bibliography and appendices. Appendices are not included in the grading evaluation.
Assessment: 7 point grading scale

5 Final examination project

The bachelor's project must document the student's understanding of and ability to reflect on the practices of the profession and the use of theory and methods in relation to a real-life problem.

Bachelor Project
Scope: 15 ECTS
Timing: By the end of 3 rd semester
Purpose: In their bachelor's project, the student must document the ability to work with a complex and practice-oriented issue in relation to a specific IT project, using an analytical and methodological approach.
Learning objectives: The final bachelor project must demonstrate that the programme's graduation level has been reached. The learning objectives for the study programme are consequently repeated below: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• The strategic role of testing in system development• Globalization of software production• System architecture and its strategic importance for the company's business• Applied theory and methodology and common technologies within the domain• Various database types and their applications. <i>Skills</i> The student can: <ul style="list-style-type: none">• Integrate IT systems and develop systems that support future integration• Use contracts as a control and coordination mechanism in the development process• Assess and select database systems, and design, redesign and optimize databases• Plan and manage development processes involving many geographically separated project participants• Plan and implement testing for large IT systems <i>Competencies</i> The student can: <ul style="list-style-type: none">• Identify links between applied theory, methods and technology and reflect on their suitability in various situations• Engage in professional collaboration to develop large systems by applying common methods and technologies• Familiarize themselves with new technologies and standards for handling integration between systems,• Through practice, develop their own competency profile from a primarily back-end developer profile to performing tasks as a system architect• Handle the establishment and realization of a business and technologically appropriate architecture for large systems.
The examination: This examination is an individual external oral exam, based on the final project report.

The minimum number of pages is 20 standard pages. The maximum number of pages for the final project report is 50 standard pages. A standard page is defined as 2400 characters, including spaces and footnotes, but excluding the front page, table of contents, bibliography and appendices. Appendices are not included in the grading evaluation.

The student presents relevant parts of the final project report in approximately 15 minutes, followed by an examination dialogue. The exam lasts for 30 minutes including assessment.

Assessment:

7 point grading scale

6 Educational elements completed abroad

The student can – with prior approval – obtain credit for any of the educational elements that have been taken abroad. In such cases the student must, after completion of his/her studies abroad, document the educational elements that have been taken. In connection with prior approval, the student must agree that the school is entitled to secure any necessary information about the educational elements.

With prior acceptance of credits, the specific educational element will be considered as being completed if the student has passed the course according to existing and relevant rules for the Computer Science education.

7 Teaching methods

At EASV, our learning approach is that business competencies are best developed when the study programme's study activities put practice and concrete issues at the heart of learning. Further we believe that that it is the work of creating value in practice that drives the motivation and commitment of our students.

EASV uses an education model that focuses on:

- Facilitating a motivating and engaging learning environment based on practice
- Transposing and disseminating relevant knowledge from research and industry in a concrete practice
- Supporting students' active participation and study intensity through relevant study activities
- Involving students' knowledge and work experience as a resource so that students are co-creators of learning
- Supporting learning through ongoing dialogue and a common feedback culture
- Flexible work, involving digital learning activities, focusing on using our resources and improving student-learning outcomes, independent of time and place.

8 Credits for elective educational elements

Any elective educational element that has been passed is considered to be equivalent to the corresponding educational element offered by other educational institutions offering the education.

The student is to apply for prior approval if credit is wished for educational elements that are not included in the education.

9 Language

English is the language used in the Bachelor in Software Development programme. Skills in other languages are not required.

9.1 Examinations

Examinations are to be submitted/presented in understandable English or Danish. Students with other native languages can seek exemption from the fact that formulation and spelling skills can influence the evaluation of the final examination project or any exam for which the curriculum specifies that such skills are included in the evaluation. Application for exemption should be sent to the head of department at least four weeks prior to the examination.

Participation requirements can also be a stipulation or prerequisite for examinations. Attendance can also be compulsory for certain of the elements in the course.

Participation and attendance requirements that are prerequisites for an examination can be found in the examination specifications of the individual course.

10 Criteria for evaluating student activity and participation requirements

To facilitate the teaching forms used, students are required to participate actively in relevant activities, including the submission and presentation of assignments and projects.

10.1 Definition of student activity and participation requirements

Enrolment can be terminated for students who have not participated actively in their studies. Active participation is defined as follows.

The student has:

- Submitted the assignments, reports, etc. which are a prerequisite for an examination in accordance with the curriculum, with a trustworthy content. This includes not having submitted material for which others have copyright.
- Attended activities with compulsory attendance as specified in the curriculum.

10.2 The consequences of absent student activity

Failure to meet one or a few of the criteria for student activity can lead to termination of the student's state educational grant (SU).

Failure to meet one or more of the criteria can lead to the termination of enrolment in the education, cf. below.

Periods in which the student is not active due to leave of absence, maternity leave, adoption, documented illness or military service are not included in the above. The student must, if so required, supply documentation for such conditions.

Exemption can be granted from the above requisites in the case of exceptional circumstances.

Applications for exemption should be sent to the head of department.

10.3 Termination of enrolment

Lack of student activity can lead to the termination of enrolment in the education.

In exceptional circumstances exceptions can be made from the rule of non-compliance of study activities. Applications to be exempted shall be sent to the head of department.

Prior to termination of enrolment in the education, the student is to be sent a written notice that points out the above-mentioned rules. This notice also specifies that the student has 14 days in which to submit documentation for periods with a lack of student activity that the student claims should not lead to expulsion, and specifies as well a deadline for seeking exemption.

If the student has not reacted within this period of time, he/she is expelled from the education. If the student requests that he/she not be expelled, this request will have a delaying effect until the head of department has decided upon the matter.

The student is entitled to submit a complaint to the head of department about a decision that has been made two weeks at the latest after being informed of the decision. This complaint will have a delaying effect. If the head of department maintains the decision, the student can complain to the Ministry of Education within two weeks after receiving the complaint, as far as legal issues are involved.

11 Re-examinations

11.1 Re-examinations due to illness

A student who has not been able to sit an examination due to documented illness or other unforeseen circumstance is given the opportunity to sit a re-examination as quickly as possible. In the case of an examination taking place at the end of the last examination period, the student is given the opportunity to sit the examination in the same examination period or immediately thereafter.

This examination can be identical to the next ordinary examination. It is the student's responsibility to investigate when the re-examination will be held.

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Information about time and place for these re-examinations can be found on EASV SharePoint.

Illness must be documented by a medical certificate received by the institution three days at the latest after the examination has been conducted. A student who becomes acutely ill during an examination must document that he/she has been ill on the day in question.

If illness is not documented according to the above rules, the examination will count as one examination attempt spent by the student.

Any costs for the medical certificate are the responsibility of the student.

11.2 Re-examinations due to failing or non-attendance

By not passing or by not attending the examination, the student is automatically registered to sit the re-examination, provided that the student has not spent all three examination attempts. The re-examination can be identical with the next ordinary examination.

It is the student's responsibility to investigate when the re-examination will be held. Information about time and place for these re-examinations can be found on EASV SharePoint.

Exemption from the above can be given in the case of extraordinary conditions, including documented disability.

12 Use of aids

Any rules for restrictions in the use of aids will be made clear in the specifications for the individual examination.

13 Special examination conditions

The student can apply for special examination conditions when warranted by physical or mental impairment. The application should be submitted to the head of department at least four weeks prior to the date of the examination. An exemption from this deadline can be given in the case of suddenly occurring health issues.

The application must be accompanied by a medical certificate, a statement from e.g. a body dealing with speech, hearing or sight impairment or dyslexia, or other forms of documentation certifying serious health issues or relevant functional impairment.

14 Cheating offences in exams

When submitting written material the student certifies by his/her signature that the material has been produced without undue assistance.

14.1 Using one's own work and that of others - plagiarism

Cheating in exams through plagiarism comprises instances where a written answer appears to be completely or partially produced personally by the student him-/herself, but:

- Comprises identical or almost identical rendering of the wording or work of others, without clearly identifying this using quotation marks, italics, indentation or other clear indications stating the source of the material, cf. the educational institution's requirements to written work on EASV SharePoint.
- Comprises major pieces of text with choice of words or formulations so close to that of another piece of writing that it is possible to determine through comparison that the text could not have been written without using the source in question
- Comprises the use of words or ideas of others without giving reference to the source in an appropriate manner
- Re-uses text and/or central ideas from the student's own previously assessed answers (self- plagiarism) without observing the provisions laid down in items 1 and 3 above.

14.2 Disciplinary procedures

- for cheating offences and disruptive behaviour during exams

A student who sits an exam and who beyond doubt during the exam:

- Receives unauthorised help
- Helps another student answer a question in the exam
- Uses unauthorised materials and aid, or
- Exhibits disruptive behaviour

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

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

14.3 Presumed cheating

- at an exam, including plagiarism during and after the exam

If during or after an exam it is presumed that a student

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

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

14.4 Investigation of cheating offences in exams, including plagiarism

Postponement of the exam

If the cheating offence concerns suspected plagiarism in a written report and/or answer that is to be used in the assessment of a subsequent oral exam, the head of department postpones the exam, unless the issue can be investigated prior to the date set for 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, containing information that can identify the individual(s) reported on, as well as a brief summary of and documentation substantiating the case. In the event of repeated offences for one or more of the persons involved, this must be stated.

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

Involving the student: hearing of the party/parties

The head of department decides whether the hearing of the student is to be oral, in writing, or a combination thereof.

For the oral hearing, the student is summoned to a clarifying interview, in which documentation substantiating the suspected cheating in the exam is presented to the student and in which the student is asked to present his/her point of view. The student has the right to be accompanied by a person of his/her own choice.

For the written hearing, the documentation substantiating the presumed cheating in the exam is sent to the student with a request for a written response to the accusation

14.5 Penalties for cheating offences and disruptive behavior during exams

If clarification of the issue confirms the presumed cheating offence, and the action has influenced or would influence the exam assessment, the head of department will expel the student from the exam.

In less serious cases, a warning is first given.

In more serious cases, the head of department can expel the student for short or long periods of time. In such cases the student receives a written warning to the effect that repeated offences could lead to permanent expulsion.

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

The student cannot sit a re-examination and cannot sit the exam again until an exam is scheduled on ordinary terms as part of the degree programme.

During the period of expulsion the student is not allowed to attend classes or sit exams.

14.6 Appeals

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

Appeals concerning legal aspects (such as incapacity, hearings, 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 in question, for the attention of the head of the degree programme. The head makes a statement on which the appellant must be given an opportunity to comment, normally within 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.

15 Complaints about examinations and appeal decisions

15.1 Complaints about exams

We recommend that the student ask the student counsellor for information about complaint procedures and guidance on how to prepare a complaint.

The rules governing complaints about exams can be found in Section 10 of the Examination Order. The Examination Order differentiates between two types of complaints:

- Complaints about the scope of the exam, the examination procedure itself and/or the assessment made
- Complaints about legal matters

These two types of complaints are dealt with differently.

15.1.1 Complaints about the scope procedure and/or the assessment

The examinee can submit a written and substantiated complaint within two weeks after the assessment of the exam has been communicated in the usual way. The complaint can cover:

- The scope of the examination, including questions asked, assignments, etc. as well the examinations relation to the objectives and requirements of the programme
- The examination procedure
- The assessment

Complaints may be submitted about all examinations – written, oral and combinations hereof, as well as practical exams.

Complaints are to be sent to the head of the degree programme.

The complaint is sent immediately to the original examiners, i.e. the internal examiner and the external examiner for the examination in question. Their statement of response

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forms the basis for the institution's decision regarding academic issues. Two weeks are normally allowed for this response.

As soon as the examiners' response is available, the student issuing the complaint is given an opportunity to comment on the statements, normally with a one-week deadline.

The institution makes its decision based on the academic opinion of the examiners and the complainant's comments hereto.

The decision is to be communicated in writing and can:

- Offer the possibility of a new assessment (re-assessment). This applies to written exams only.
- Offer the possibility of a new exam (re-examination) with new examiners, or
- Reject the complaint

If the decision is to offer a re-assessment or re-examination, the head of department appoints new examiners. Re-assessment applies only to written exams for which material is available, as the new examiners cannot make a (re-)assessment of an oral examination and because the notes made by the original examiners are personal and cannot be disclosed.

If the decision is to offer reassessment or re-examination, the complainant must be informed of the fact that the re-assessment or re-examination may lead to a lower grade.

The student must accept the offer within a period of two weeks after the decision has been communicated. Acceptance can thereafter not be cancelled. If the student does not accept the offer within this period of time, there will be no re-assessment or re-examination.

The re-assessment or re-examination must take place as quickly as possible.

In the case of re-assessment, all documentation shall be provided to the new examiners – the assignment, the answer, the complaint, the evaluations made by the original examiners – together with the complainant's comments and the educational institute's decisions.

The new examiners notify the educational institution of the outcome of their re-assessment and enclose a written statement that specifies the assessment and the reasons for it. Re-assessments may result in a lower grade.

If the decision is to offer re-assessment or re-examination, the decision applies to all students whose examination suffers from the same defects as those referred to in the complaint. The complaint is sent to the head of department 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.

Exemption from this deadline can be given in the event of exceptional circumstances.

Appeals and complaints about appeal decisions

The complainant can submit the educational institution's decision to an appeals panel.

The activities of the appeals panel are governed by the Public Administrations Act, which also includes issues of incapacity and confidentiality.

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

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

The appeals panel consists of two authorised external examiners 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 appeals panel makes decisions based on the material used by the educational institution in making its decision and the student's appeal, with reasons stated.

The appeals panel can:

- Offer the possibility of a new assessment with new examiners. This applies to written exams only.
- Offer the possibility of a new exam with new examiners, or
- Reject the appeal

If the decision is to offer reassessment or re-examination, the complainant must be informed of the fact that the re-assessment or re-examination may lead to a lower grade.

The student must accept the offer within a period of two weeks after the decision has been communicated. Acceptance can thereafter not be cancelled. If the student does not accept the offer within this period of time, there will be no re-assessment or re-examination.

The re-assessment or re-examination must take place as quickly as possible.

In the case of re-assessment, all documentation shall be provided to the appeals panel – the assignment, the answer, the complaint, the evaluations made by the original examiners – together with the complainant's comments and the educational institute's decisions.

The appeals panel must make its decision two months at the latest (in the case of spring semester exams three months) after the submission of the appeal.

The decision of the appeals panel is final, which means that the case cannot be brought before a higher administrative authority as far as the academic part of the complaint is concerned.

15.1.2 Complaints about legal matters

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

Complaints about legal aspects of decisions made by the institution according to the rules laid down by the Examination Order (e.g. incapacity, hearings, correct or incorrect interpretation of the Examination Order) can be submitted to the educational institution.

Bachelor in Software Development

The institution issues a statement and the complainant is normally given one week in which to respond with his/her comments. The institution forwards the complaint, the statement and any comments the complainant may have to the Danish Agency for Higher Education and Educational Support.

Complaints must be submitted to the educational institution at the latest two weeks (14 calendar days) after the day on which the decision has been communicated to the complainant.

16 Exemptions

The institute can grant exemptions from rules in this institution-specific section of the curriculum in cases where such exemption is justified due to exceptional circumstances. The institutions offering this education cooperate to ensure a uniform exemption practice.

17 Effective date and transition period

This curriculum takes effect by 1 August 2020. Students admitted after this date will follow this curriculum. The curriculum is based on;

- Ministerial order Technical and Mercantile Academy profession programmes and Professional Bachelor Programmes (tekniske og merkantile erhvervsakademiuddannelser og professionsbacheloruddannelser)
- Ministerial Exame order (Eksamensbekendtgørelsen)
- Ministerial Sccess to business academy programs and professional bachelor programs order (adgang til erhvervsakademiuddannelser og professionsbacheloruddannelser)

All can be found here: <https://www.retsinformation.dk/>

18 Appendix

Functional Programming
Timing: 1 st year of study
Scope: 5 ECTS
Content: The purpose of the course is to give the student a comprehensive understanding of the fundamental concepts and techniques in functional programming. The student will be able to construct small to medium size programs using a programming language supporting the functional paradigm.
<p>Learning objectives:</p> <p><i>Knowledge</i> The student must have knowledge of:</p> <ul style="list-style-type: none"> • Mutability of functions • The functional paradigm in programming • Recursion and how to emulate iteration using recursion • The scope of functional programming <p><i>Skills</i> The student can:</p> <ul style="list-style-type: none"> • Use a modern functional programming language • Model a computation as a composition of functions • Design and implement 2nd-order functions • Design and implement functions working with different kind of collections • Design and implement small to medium size programs using the functional programming language <p><i>Competencies</i> The student can:</p> <ul style="list-style-type: none"> • Choose and validate components of an IT-system that are suitable to implement using the functional paradigm • Integrate the functional paradigm in a multi-paradigm IT-system
The examination: Internal oral exam based on synopsis.
Assessment: Passed/failed

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are study activity requirements that must be met in order to be qualified to do the exam. These requirements are described in the course description. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of study activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the

consequences of lack of participation are made by the student counsellor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

Parallel Programming
Timing: 1 st year of study
Scope: 5 ECTS
Content: This subject element must help ensure that the student develops the competencies in assessing the applicability of parallelization of algorithms for solving a given problem, and to construct parallel algorithms that efficiently utilize the available logical cores of the underlying system.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Key concepts associated with parallel programming, including data parallelism, task parallelism, task synchronization and pipelines.• Requirements for parallelizing algorithms.• Calculating the optimal performance gains that can be achieved through the parallelization of an algorithm.• Key concepts associated with concurrent programming, including critical section, deadlock, starvation, and synchronization primitives used for synchronization.• Asynchronous programming. <i>Skills</i> The student can: <ul style="list-style-type: none">• Design and implement parallel algorithms for a given parallelizable problem in a concrete programming language.• Use asynchronous programming for improved responsiveness of an application implemented in a concrete programming language.• Use synchronization primitives for concurrent programming in a concrete programming language. <i>Competencies</i> The student can: <ul style="list-style-type: none">• Assess the applicability of parallelization for solving a given problem and implement the chosen solution so that it efficiently utilizes the available cores of the underlying system.
The examination: The examination will be an internal individual oral exam of 20 min. duration based on a written synopsis within a topic chosen by the student and related to the course. The student presents the synopsis topic for 10 minutes, followed by a dialogue of 5 - 7 min. between the student and examiner in subjects from the course syllabus.

Assessment: 7 point grading scale

Prerequisites for the course

Knowledge of the object-oriented paradigm, and skills in programming in an object-oriented programming language.

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are compulsory participation requirements that must be met in order to be qualified to do the exam. These requirements are described in the course plan for each course. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of academic activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the consequences of lack of participation are made by the student counsellor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

Internet of Things
Timing: 1 st year of study
Scope: 10 ECTS
Content: The purpose of this course is to train the student to be able to develop IoT devices and integrate them with richer clients using current cloud technologies and asynchronous communication. The student will be able to setup and program basic IoT devices. Doing integration with servers for data collection and presenting the data using current web technologies.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Common IoT device hardware and software technologies• Common network protocols for IoT device infrastructure• Options/languages for programming IoT devices• IoT device operating systems• Basic electronics for IoT devices• Sensors and actuators• Relevant cloud-based communication technology for integration of IoT devices and

<p>web systems</p> <p><i>Skills</i> The student can:</p> <ul style="list-style-type: none">• Develop programs for publishing data from IoT devices to the cloud• Develop IoT devices for collecting data from the surroundings• Develop IoT devices that is able to manipulate the surroundings• Enable IoT devices to react on requests from the web• Implement current IoT network communication• Implement data-visualization of data collected from IoT devices <p><i>Competencies</i> The student can:</p> <ul style="list-style-type: none">• Analyze requirements of a specific IoT project• Choose suitable network technologies for implementation of IoT in a specific project context• Choose a suitable setup and programming language for implementation of IoT in a specific project context
<p>The examination: Internal oral exam based on final project.</p>
<p>Assessment: 7-point scale</p>

Prerequisites for the exam, including compulsory participation

The following requirements apply:

There are study activity requirements that must be met in order to be qualified to do the exam. These requirements are described in the course description. Failure to meet these requirements without a valid reason (e.g. illness, maternity leave or exceptional circumstances) is considered to indicate a lack of study activity and can lead to suspension of any state education grant or termination of enrolment. Decisions on the consequences of lack of participation are made by the student counsellor in consultation with the head of department after meeting with the student in question, and will be based on an individual assessment.

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CURRICULUM

for

Bachelor's Degree Programme in Software
Development

Revised June 9 and August 24 2017

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This national part of the curriculum for the Bachelor's Degree Programme in Software Development has been released in accordance with section 18(1) in the Ministerial Order for technical and commercial Academy Profession Programmes and Professional Bachelor Programmes. This curriculum is supplemented with an institutional component, provided by the institution offering the programme.

After it has been approved by either the Board of Directors (or the Rectors) and after consultation with the institutions' Educational Committee and the External Examiners' chairmanship for the specific programme, the educational network for the Bachelor's Degree Programme in Software Development prepares the institutional part.

1. The programme's goals for learning outcomes

Knowledge

The student must have knowledge of:

- The strategic role of testing in system development
- Globalisation of software production
- System architecture and its strategic importance for the company's business
- Applied theory and methodology and common technologies within the domain
- Various database types and their applications.

Skills

The student can:

- Integrate IT systems and develop systems that support future integration
- Use contracts as a control and coordination mechanism in the development process
- Assess and select database systems, and design, redesign and optimise databases
- Plan and manage development processes involving many geographically separated project participants
- Identify links between applied theory, methods and technology and reflect on their suitability in various situations

Competencies

The student can:

- Plan and implement testing for large IT systems
- Engage in professional collaboration to develop large systems by applying common methods and technologies
- Familiarise themselves with new technologies and standards for handling integration between systems,
- Through practice, develop their own competency profile from a primarily back-end developer profile to performing tasks as a system architect
- Handle the establishment and realisation of a business and technologically appropriate architecture for large systems.

2. The programme includes four national subject elements

2.1. Developing Large Systems

Developing Large Systems

Scope: 10 ECTS
Content: The aim of the subject element is to TRAIN the student to develop large-scale IT systems, where scalability is a key characteristic. The student must have knowledge of how key system development methods handle issues related to scalability and the development of large distributed systems. The student must have knowledge of concepts, techniques and technologies for the continuous integration and delivery of software-based systems. The student must be able to design, implement, and maintain large distributed systems in distributed development teams.
<p>Learning objectives:</p> <p><i>Knowledge</i></p> <p>The student must have knowledge of:</p> <ul style="list-style-type: none"> • Issues related to the development of distributed and large-scale IT systems, and how disciplined and agile development methods prescribe how these issues should be handled • The advantages, disadvantages and costs of using a system for the continuous integration and delivery of IT systems • Quality criteria for the design of interfaces to subsystems • Configuration and error reporting systems dedicated to the development of large distributed systems <p><i>Skills</i></p> <p>The student can:</p> <ul style="list-style-type: none"> • Apply techniques for dividing a system into subsystems • Design and specify requirements for subsystems • Use version control systems dedicated to the development of large distributed systems in a distributed development team • Use a system for continuous integration and delivery • Use architecture patterns dedicated to the development of large distributed systems. <p><i>Competencies</i></p> <p>The student can:</p> <ul style="list-style-type: none"> • Cooperate in large systems development organizations • Participate in globally distributed development • Adapt development methods and processes to the development of large distributed systems

2.2. Databases for Developers

Databases for Developers
Scope: 10 ECTS
Content: The aim of the subject element is to train the student to be able to select and apply various database types appropriately in relation to various fields of application. The student must also be able to analyse and develop in relation to large databases, including redesign and optimisation.
<p>Learning objectives:</p> <p><i>Knowledge</i></p>

The student must have knowledge of:

- Various database types and the underlying models
- A specific database system's storage organisation and query execution
- A specific database system's optimisation possibilities – including advantages and disadvantages
- Database-specific security problems and their solutions
- Concepts and issues in relation to data warehousing, including big data
- The particular issues raised by having many simultaneous transactions, including in connection with distributed databases
- Relational algebra (including its relationship to execution plans)

Skills

The student can:

- Transform logical data models into physical models in various database types
- Implement database optimisation
- Use parts of the administration tool to assist in the optimisation and tuning of existing databases, including the incorporation of a specific DBMS' execution plans
- Use a specific database system's tools for handling simultaneous transactions
- Use the programming and other facilities provided by a modern DBMS
- Use an object-relational mapping tool

Competencies

The student can:

- Analyse the application domain in order to select a database type
- Divide responsibility for tasks between the application and DBMS during system development, to ensure the best possible implementation.

2.3. System Integration

System Integration
Scope: 10 ECTS
Content: This subject element must help ensure that the student develops the competencies to be able to work with technical system integration. After completing this module, the student must be able to integrate existing systems in connection with the development of new systems, and develop new systems supporting future integration.
Learning objectives: <i>Knowledge</i> The student must have knowledge of: <ul style="list-style-type: none">• Business considerations in relation to system integration• Standards and standards organisations• Storage, transformation and integration of data sources

- The concept of services and its tie to service-oriented architectures
- Technologies which can be used to implement a service-oriented architecture
- Tools for integration.

Skills

The student can:

- Use an object-oriented system in a service-oriented architecture
- Design a system that is easy to integrate with other systems, and uses existing services
- Transform or expand a system so that it can function in a service-oriented architecture
- Use patterns that support system integration
- Integrate generic and other systems
- Choose from various integration methods
- Translate elements in a business strategy into specific requirements for system integration.

Competencies

The student can:

- Choose from various integration techniques
- Acquire knowledge of developments in standards for integration
- Adapt IT architecture to take into account future system integration.

2.4. Testing

Testing
Scope: 10 ECTS
Content: The aim of the subject element is to train students in planning and conducting testing. The student must understand the place and significance of testing in methods for system development. The student must be able to design and carry out systematic testing for large systems, including the establishment of automated testing. The student must also master concepts and techniques for the design and construction of testable systems.
<p>Learning objectives:</p> <p><i>Knowledge</i></p> <p>The student must have knowledge of:</p> <ul style="list-style-type: none"> • Significant test strategies and models and their role in system development • Testing as an integral part of a development project • Various types of testing and their applications. <p><i>Skills</i></p> <p>The student can:</p> <ul style="list-style-type: none"> • Ensure traceability between system requirements and testing at all levels • Apply both black-box and white-box testing techniques • Apply various criteria for the degree of test coverage • Use techniques for verification and validation • Use techniques and tools for automated testing

- Build systems to manage testing and the fault rectification process in development projects.

Competencies

The student can:

- Define, plan and carry out testing in a development project that matches the project's quality requirements
- Plan and manage the implementation of internal and external testing of software systems.
- Design testable systems

2.5. The number of exams in the national subject elements

There are 4 exams in the national subject elements, as well as one further exam in the bachelor project. For the number of exams in the internship, please refer to section 3.

For a comprehensive overview of all the programme's exams, please refer to the institutional part of the curriculum, as the national subject elements described in this curriculum can be examined together with the subject elements specified in the institutional part of the curriculum.

3. Internship

Learning objectives for the programme's internship

Internship
Scope: 15 ECTS
Content: The internship is organised so that it contributes – in combination with the rest of the study programme – to the student developing practical competencies. The aim of the internship is to enable the student to apply the programme's methods, theories and tools by performing specific practical software development tasks.
<p>Learning objectives:</p> <p><i>Knowledge</i></p> <p>The student must have knowledge of:</p> <ul style="list-style-type: none"> • Daily operations throughout the internship company. <p><i>Skills</i></p> <p>The student can:</p> <ul style="list-style-type: none"> • Apply versatile technical and analytical working methods linked to employment within the profession • Evaluate practice-oriented issues and identify possible solutions • Manage the structuring and planning of day-to-tasks within the profession • Communicate practice-oriented issues and reasoned solution proposals. <p><i>Competencies</i></p> <p>The student can:</p>

- Handle development-oriented, practical and professional situations in relation to the profession.
- Acquire new knowledge, skills and competencies related to the profession
- Participate in academic and interdisciplinary collaboration with a professional approach.

Number of examinations:

1

4. Requirements for the bachelor project

The learning objectives for the bachelor project are identical to the programme's learning objectives listed above under section 1.

The bachelor's project must document the student's understanding of and ability to reflect on the practices of the profession and the use of theory and methods in relation to a real-life problem. The problem statement, which must be central to the programme and profession, is formulated by the student, possibly in collaboration with a private or public company. The Academy approves the problem statement.

Bachelor project
Scope: 15 ECTS
Content: In their bachelor's project, the student must document the ability to work with a complex and practice-oriented issue in relation to a specific IT project, using an analytical and methodological basis.
Learning objectives: The final bachelor project must demonstrate that the programme's graduation level has been reached, see chapter 1 of this document.
Assessment: <ul style="list-style-type: none"> • The exam is an oral and written examination with an external co-examiner. A combined mark is given based on the 7-point scale for the written project and the oral presentation.

5. Rules on credit

Passed programme elements are equivalent to similar programme elements taken at other educational institutions offering this programme.

Students are obliged to inform us of any completed educational elements from another Danish or foreign higher education programme or any jobs which are likely to provide credit.

The Academy approves credit, in each instance, on the basis of completed programme elements and any jobs which meet the objectives of the subjects, the educational part and the internship parts.

The decision is based on an academic assessment.

For prior credit approval of studies in Denmark or abroad, students are required to document each approved and completed programme element on the completion of these studies.

In connection with applying for prior credit approval, the students give the Academy permission to obtain the necessary information after the student's completion.

Following approval according to the above, the programme element is deemed to be passed if it was passed according to the rules of the programme in question.

6. Academic criteria for selecting candidates for top-up programmes

Having completed a computer science fulfils the formal admission requirements for the professional bachelor programme in software development.

If there are more applicants than student places, applicants will be according to the following criteria:

- Average grade from the qualifying study programme
- Grades and ECTS credits in programming and system development
- Relevant work experience

7. Commencement and transitional schemes

Commencement

All enrolled students will be transferred to this curriculum on 1 September 2017.

Simultaneously, previous joint national curricula are NOT valid from this date.