



Programme syllabus

Master's Programme, Computer Science, 120 credits

Masterprogram, datalogi

120.0 credits

Valid for students admitted to the education from autumn 18 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

The aim of the Master's programme is to provide a broad education in Computer Science with the possibility of deepening and specializing within the area of computer science, the method science for construction of computer programmes including theoretical foundations as well as the practical ability to develop products and systems which include computers and software.

The programme will provide the students with the requisites and abilities to participate and lead work within evaluation, development and implementation of new technology within the field of computer science.

In addition to this comes the Higher Education Ordinance goal for Master's degree.

Knowledge and understanding

The objective of the programme is to provide the student with deepened knowledge within computer science and engineering,

The program will also provide students with advanced knowledge, including understanding of the methodology and the scientific perspective, within an area of computer science.

Skills and abilities

The objective of the program is to provide the student with:

- a good analytical problem solving ability,
- the ability to independently define and solve construction problems within computer science,
- the requisites and abilities to participate in and develop practices implemented in industry, maintenance and academic research,

- the requisites for successful work in international and interdisciplinary project groups which include engineers and non-engineers. This goal includes abilities in oral and written presentation and argumentation in Swedish and English.

Ability to make judgements and adopt a standpoint

The objective of the programme is that the student should:

- be able to evaluate the quality of scientific studies and show a reflective and critical approach to scientific and non-scientific texts,
- through self-development, retain his/her own professional ability during a professional career,
- follow the discussion about technology in society and contribute to it.

Beyond this, there are similar goals for the Master of Science in Engineering programme which are defined by the higher education ordinance.

Extent and content of the programme

The programme is in the second cycle and comprises 120 ECTS credits, which, at normal study rate, corresponds to two years. The programme is given in English, but some elective courses are given in Swedish.

The programme offers specializations of which one is to be chosen:

- Data Science
- Interaction Design
- Cognitive Systems
- Software Technology
- Theoretical Computer Science
- Scientific Computing
- Visualization and Interactive Graphics

Under special circumstances and individual track can be approved by the programme director.

Eligibility and selection

General Admission Requirements: See KTHs admission requirements for Master's Programmes, www.kth.se/en/

Special Admission Requirements:

The minimum criterias are that the following must be in the bachelor degree

- **Mathematics:** three different subjects of a total of 22,5 credits. Among those subjects there must be a course in one-variabel calculus, a course in linear algebra and a course in discrete structures.
- **Computer Science/Information technology:** three different subjects of a total of 22.5 credits. Among those subjects there must be a course in object oriented programming, a course in algorithms and data structures and a course in computational complexity.

A course in Calculus in Several Variable is required to follow the tracks Data analysis, Cognitive systems and Scientific computing.

Selection process:

If the number of applicants exceeds the number of places available a programme committee will make a selection from the following criterias:

1. evaluation of university
2. grades from previous study
3. motivation to study

The evaluation scale is 1-75.

Implementation of the education

Structure of the education

Structure of the education

This programme syllabus decided by the CSC dean 2016-09-01 is valid for students starting the programme during the study year 2017/2018.

The KTH academic year is 40 weeks, divided into four periods.

For details about the structure of the academic year see <http://www.kth.se/en/>

During the first study year, five compulsory courses are taken, a total of 30 ECTS credits.

Beside the compulsory courses the students must follow a track in the computer science master. The track consist of 30 ECTS credits of compulsory or conditionally elective courses which will deepen the knowledge in a field of computer science.

A Programme Integrating Course, 2 hp, spread over two years is also compulsory for the programme

The programme is concluded by a degree project comprising 30 ECTS credits.

Other courses are elective.

Courses

The programme is course-based. Lists of courses are included in [appendix 1](#).

The course goals, prerequisites, contents and examination requirements are found in the course syllabus in the Course and program directory on the KTH student web. For each study year there is a course list.

For elective courses, the following restrictions apply:

- The number of credits that can be chosen per semester can be limited.
- Elective courses may not overlap a course already taken to a considerable extent.
- Courses on lower levels within a subject than the programme courses may not count as elective courses.

Courses are examined in many ways, for example by home assignments that are presented either using oral presentations or written reports, computer assignments, project work or traditional written exams.

After each course a student evaluation is performed and then analyzed by the course leader in the course analysis document, which is normally published on the web, see the KTH regulations of course analysis: <http://www.kth.se/en/>

Grading system

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Since the grading systems differ very much between different countries, the grades are not translated from exchange studies abroad.

Conditions for participation in the programme

Participation requires admission to courses within the programme and course registration. Course registration is done via the personal menu at www.kth.se

Selection of track is done according to instructions from the CSC school.

Selection of courses

The student is required to apply for admission to all courses he/she wishes to take during the next semester. The student is responsible for having the recommended prerequisites. The application for admission to a course is done according to instructions from the CSC education administration office no later than

- May 15th for the fall semester
- November 15th for the spring semester

Applications made after this date are only granted if there are vacancies in the courses. Applications to language courses with prerequisites should be preceded by a qualification test.

In a few courses, the number of participants is limited. Selection is done by the school responsible for the course and the criteria is published on the course web page.

A student may only take courses that are included in the study plan.

Promotion for further studies

For students starting their education from the autumn semester 2018, previous promotion requirements have been replaced with special admission requirements to each course. Admission requirements are specified in the course syllabus.

Please see the KTH regulations: <http://www.kth.se/>

Recognition of previous academic studies

Credits for studies at another university can be transferred. An application form can be found on the KTH Student pages.

The application form is submitted to the CSC education administration office.

For in-depth information about the KTH policy for credit transfer, see <http://www.kth.se/en/>

Studies abroad

Students of the programme have the possibility to spend one or two semesters of study at a foreign university through agreements KTH has with universities within and outside the EU. It is also possible to make the final degree project abroad.

For more information contact the international coordinator at CSC.

Degree project

The degree project is the final part of the education and comprises 30 higher education credits. The project work may begin when special admission requirements for the course are fulfilled.

It is the responsibility of the student to find a suitable project task.

More information about the rules for degree projects at KTH can be found at: <http://www.kth.se/en/>

Degree

After completing the programme, the student may apply for the degree "Teknologie Masterexamen", translated to English "Master of Science".

Information on the application process can be found on the KTH Student pages.

Requirements for the Degree of Master of Science (Two Years)

The Degree of Master of Science (Two Years) is obtained after completion of the programme. The programme is designed so that students, when they graduate, have fulfilled the national requirements for a degree. This means that the students have completed courses comprising 120 ECTS credits, of which at least 90 ECTS credits are second cycle, and at least 60 ECTS credits (including a 30 ECTS credits degree project) constitute indepth studies in the main field of study.

See also the KTH regulations: <http://www.kth.se/en/>

[Appendix 1 - Course list](#)

[Appendix 2 - Programme syllabus descriptions](#)



Appendix 1: Course list

Programme syllabus for studies starting in autumn 2018, Master's Programme, Computer Science, 120 credits (TCSCM)

General courses

Year 1

Mandatory courses (32.0 Credits)

Code	Name	Credits	Edu. level
DA2210	Introduction to the Philosophy of Science and Research Methodology for Computer Scientists	6.0 hp	Second cycle
DD2300	Program Integrating Course in Computer Science <i>One credit each academic year</i>	2.0 hp	Second cycle
DD2380	Artificial Intelligence	6.0 hp	Second cycle
DD2395	Computer Security	6.0 hp	Second cycle
DD2440	Advanced Algorithms	6.0 hp	Second cycle
IK2218	Protocols and Principles of the Internet	6.0 hp	Second cycle

Supplementary information

Students from CTFYS or CINTE who miss the equivalent courses in previous degree are also required to take:

- DD2350 Algorithms, Data Structures and Complexity 9,5 credits or DD2352 Algorithms and Complexity 7.5 cr.
- SF1662 Discrete Mathematics 7,5 cr, SF1610 Discrete Mathematics, 7,5 cr. or SF1679 Discrete Mathematics 7.5 cr.

The course ID2200 Operating system 6 hp is compulsory for students from the engineering programme in Computer Science, who started 2011 or earlier.

The course Sustainability and Media Technology 7.5 credits is compulsory for studenter from the engineering programme in Media Technology.

The course IK2218 Protocols and Principles of the Internet. should be replaced by an elective course, of at least 6 cr. for students from CINTE.

Year 2

Mandatory courses (32.0 Credits)

Code	Name	Credits	Edu. level
DA231X	Degree Project in Computer Science and Engineering, Second Cycle	30.0 hp	Second cycle
DD2300	Program Integrating Course in Computer Science <i>One credit each academic year</i>	2.0 hp	Second cycle

Supplementary information

Students from CTFYS or CINTE who miss the equivalent courses in previous degree are also required to take:

- DD2350 Algorithms, Data Structures and Complexity 9,5 credits or DD2352 Algorithms and Complexity 7.5 cr.
- SF1662 Discrete Mathematics 7,5 cr, SF1610 Discrete Mathematics, 7,5 cr. or SF1679 Discrete Mathematics 7.5 cr.

The course ID2200 Operating system 6 hp is compulsory for students from the engineering programme in Computer Science, who started 2011 or earlier.

The course Sustainability and Media Technology 7.5 credits is compulsory for studenter from the engineering programme in Media Technology.

Students from CINTE should not follow the course IK2218 Protocols and Principles of the Internet.

Track, Cognitive Systems (CSCS)

Year 1

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
DD2421	Machine Learning	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
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DD2410	Introduction to Robotics <i>Compulsory for the subtrack Vision and robotics</i>	7.5 hp	Second cycle
DD2418	Language Engineering <i>Conditionally elective for the subtrack Conversational systems</i>	6.0 hp	Second cycle
DD2423	Image Analysis and Computer Vision <i>Compulsory for the subtrack Vision and robotics</i>	7.5 hp	Second cycle
DD2424	Deep Learning in Data Science <i>Compulsory for the subtrack Vision and robotics, Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures <i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2112	Speech Technology <i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2119	Speech and Speaker Recognition <i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2140	Multimodal Interaction and Interfaces <i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2150	Project in Cognitive Systems <i>Compulsory for the subtrack Conversational systems</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2429	Computational Photography	6.0 hp	Second cycle
DD2434	Machine Learning, Advanced Course	7.5 hp	Second cycle
DD2438	Artificial Intelligence and Multi Agent Systems	15.0 hp	Second cycle
DD2447	Statistical Methods in Applied Computer Science	6.0 hp	Second cycle
DD2476	Search Engines and Information Retrieval Systems	9.0 hp	Second cycle
DM2350	Human Perception for Information Technology	7.5 hp	Second cycle
DT1130	Spectral Transforms	7.5 hp	First cycle
DT2410	Audio Technology	7.5 hp	Second cycle
EL2320	Applied Estimation	7.5 hp	Second cycle
EQ2341	Pattern Recognition and Machine Learning	7.5 hp	Second cycle
SF1811	Optimization	6.0 hp	First cycle
SF2940	Probability Theory	7.5 hp	Second cycle

Supplementary information

The student choose one of the subtrack:

- 1) Vision and robotics
- 2) Conversational system

Mandatory courses, subtrack Vision and Robotics:

DD2423 Image Analysis and Computer Vision, 7.5 credits

DD2424 Deep Learning in Data Science, 7.5 credits

DD2410 Introductory course in Robotics, 7,5 credits

Mandatory course, subtrack Conversational system:

DT2150 Project course in Cognitive Systems, 7,5 credits

Conditionally elective course, subtrack Conversational system (one of the courses must be chosen):

DT2119 Speech and Speaker Recognition 7,5 credits

DT2112 Speech technology 7,5 credits

Conditionally elective course, subtrack Conversational system (one of the courses must be chosen):

DD2424 Deep Learning in Data Science 7.5 credits

DD2437 Artificial Neural Networks and Deep Architectures 7.5 credits

DT2140 Multimodal Interaction and Interfaces 7.5 credits

DD2418 Language Engineering 6.0 credits

Subject to changes.

Year 2

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2410	Introduction to Robotics <i>Compulsory for the subtrack Vision and robotics</i>	7.5 hp	Second cycle
DD2418	Language Engineering <i>Conditionally elective for the subtrack Conversational systems</i>	6.0 hp	Second cycle
DD2423	Image Analysis and Computer Vision <i>Compulsory for the subtrack Vision and robotics</i>	7.5 hp	Second cycle
DD2424	Deep Learning in Data Science <i>Compulsory for the subtrack Vision and robotics, Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DD2425	Robotics and Autonomous Systems <i>Will not be given. Replaced by DD2410</i>	9.0 hp	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures <i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle

DT2112 Speech Technology	<i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2119 Speech and Speaker Recognition	<i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2140 Multimodal Interaction and Interfaces	<i>Conditionally elective for the subtrack Conversational systems</i>	7.5 hp	Second cycle
DT2150 Project in Cognitive Systems	<i>Compulsory for the subtrack Conversational systems</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2429	Computational Photography	6.0 hp	Second cycle
DD2434	Machine Learning, Advanced Course	7.5 hp	Second cycle
DD2438	Artificial Intelligence and Multi Agent Systems	15.0 hp	Second cycle
DD2447	Statistical Methods in Applied Computer Science	6.0 hp	Second cycle
DD2476	Search Engines and Information Retrieval Systems	9.0 hp	Second cycle
DM2350	Human Perception for Information Technology	7.5 hp	Second cycle
DT1130	Spectral Transforms	7.5 hp	First cycle
DT2410	Audio Technology	7.5 hp	Second cycle
EL2320	Applied Estimation	7.5 hp	Second cycle
SF1861	Optimization	6.0 hp	First cycle
SF2940	Probability Theory	7.5 hp	Second cycle

Supplementary information

Students studying the Cognitive Systems track choose a subtrack consisting of mandatory and conditionally elective courses studied in year one and two

The student choose one of the subtrack:

- 1) Vision and robotics
- 2) Conversational system

Mandatory courses, subtrack Vision and Robotics:

DD2423 Image Analysis and Computer Vision, 7.5 credits

DD2424 Deep Learning in Data Science, 7.5 credits

DD2410 Introductory course in Robotics, 7,5 credits

Mandatory course, subtrack Conversational system:

DT2150 Project course in Cognitive Systems, 7,5 credits

Conditionally elective course, subtrack Conversational system (one of the courses must be chosen):

DT2119 Speech and Speaker Recognition 7,5 credits

DT2112 Speech technology 7,5 credits

Conditionally elective course, subtrack Conversational system (one of the courses must be chosen):

DD2424 Deep Learning in Data Science 7.5 credits

DD2437 Artificial Neural Networks and Deep Architectures 7.5 credits

DT2140 Multimodal Interaction and Interfaces 7.5 credits

DD2418 Language Engineering 6.0 credits

Subject to changes.

Track, Data Science (CSDA)

Year 1

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
DD2421	Machine Learning	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2404	Applied Bioinformatics <i>Compulsory for the subtrack Bioinformatics</i>	7.5 hp	Second cycle
DD2418	Language Engineering <i>Compulsory for the subtrack Natural Language Processing</i>	6.0 hp	Second cycle
DD2420	Probabilistic Graphical Models <i>Conditionally elective for the subtrack Machine learning</i>	7.5 hp	Second cycle
DD2424	Deep Learning in Data Science <i>Compulsory for the subtrack Machine Learning</i>	7.5 hp	Second cycle
DD2434	Machine Learning, Advanced Course <i>Conditionally elective for the subtrack Machine learning</i>	7.5 hp	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures <i>Conditionally elective for the subtrack Machine learning</i>	7.5 hp	Second cycle
DD2476	Search Engines and Information Retrieval Systems <i>Compulsory for the subtrack Natural Language Processing</i>	9.0 hp	Second cycle
SF2940	Probability Theory <i>Compulsory for the subtrack Bioinformatics</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2257	Visualization	7.5 hp	Second cycle
DD2423	Image Analysis and Computer Vision	7.5 hp	Second cycle
DD2425	Robotics and Autonomous Systems	9.0 hp	Second cycle
DD2429	Computational Photography	6.0 hp	Second cycle
DD2438	Artificial Intelligence and Multi Agent Systems	15.0 hp	Second cycle
DD2447	Statistical Methods in Applied Computer Science	6.0 hp	Second cycle
DH2320	Introduction to Visualization and Computer Graphics	6.0 hp	Second cycle
DH2321	Information Visualization	6.0 hp	Second cycle
DT2112	Speech Technology	7.5 hp	Second cycle
DT2119	Speech and Speaker Recognition	7.5 hp	Second cycle
EL2320	Applied Estimation	7.5 hp	Second cycle
SF1811	Optimization	6.0 hp	First cycle

Supplementary information

One of the subtracks must be chosen.

1. Machine Learning
2. Natural languages processing
3. Bioinformatics

Mandatory courses, subtrack Machine Learning

DD2424 Deep Learning in Data Science, 7.5 credits

Conditionally elective courses, subtrack Machine Learning (one of the courses must be chosen):

DD2434 Machine Learning, Advanced Course, 7.5 credits

DD2437 Artificial Neural Networks and Deep Architectures 7.5 credits

DD2420 Probabilistic graphical methods, 7,5 credits

Mandatory courses, subtrack Natural Language Processing

DD2476 Search Engines and Information Retrieval Systems, 9.0 credits

DD2418 Language Engineering, 6.0 credits

Mandatory courses, subtrack Bioinformatics

SF2940 Probability Theory 7.5 credits

DD2404 Applied Bioinformatics, 7.5 credits

Subject to changes

Year 2

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
DD2430	Project Course in Data Science	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2418	Language Engineering <i>Compulsory for the subtrack Natural Language Processing</i>	6.0 hp	Second cycle
DD2420	Probabilistic Graphical Models <i>Conditionally elective for the subtrack Machine learning</i>	7.5 hp	Second cycle
DD2424	Deep Learning in Data Science <i>Compulsory for the subtrack Machine learning</i>	7.5 hp	Second cycle
DD2434	Machine Learning, Advanced Course <i>Conditionally elective for the subtrack Machine learning</i>	7.5 hp	Second cycle
DD2476	Search Engines and Information Retrieval Systems <i>Compulsory for the subtrack Natural Language Processing</i>	9.0 hp	Second cycle
SF2940	Probability Theory <i>Compulsory for the subtrack Bioinformatics</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2257	Visualization	7.5 hp	Second cycle
DD2423	Image Analysis and Computer Vision	7.5 hp	Second cycle
DD2425	Robotics and Autonomous Systems	9.0 hp	Second cycle
DD2429	Computational Photography	6.0 hp	Second cycle
DD2438	Artificial Intelligence and Multi Agent Systems	15.0 hp	Second cycle
DD2447	Statistical Methods in Applied Computer Science	6.0 hp	Second cycle
DH2320	Introduction to Visualization and Computer Graphics	6.0 hp	Second cycle
DH2321	Information Visualization	6.0 hp	Second cycle
DT2112	Speech Technology	7.5 hp	Second cycle
DT2119	Speech and Speaker Recognition	7.5 hp	Second cycle
EL2320	Applied Estimation	7.5 hp	Second cycle
SF1861	Optimization	6.0 hp	First cycle

Supplementary information

Students studying the Data Science track choose a subtrack consisting of mandatory and conditionally elective courses studied in year one and two.

One of the subtracks must be chosen.

1. Machine Learning
2. Natural languages processing
3. Bioinformatics

Mandatory courses, subtrack Machine Learning

DD2424 Deep Learning in Data Science, 7.5 credits

Conditionally elective courses, subtrack Machine Learning (one of the courses must be chosen):

DD2434 Machine Learning, Advanced Course, 7.5 credits

DD2437 Artificial Neural Networks and Deep Architectures 7.5 credits

DD2420 Probabilistic Graphical Models, 7,5 credits

Mandatory courses, subtrack Natural Language Processing

DD2476 Search Engines and Information Retrieval Systems, 9.0 credits

DD2418 Language Engineering, 6.0 credits

Mandatory courses, subtrack Bioinformatics

SF2940 Probability Theory 7.5 credits

DD2404 Applied Bioinformatics, 7.5 credits

Subject to changes

Track, Interaction Design (CSID)

Year 1

Mandatory courses (15.0 Credits)

Code	Name	Credits	Edu. level
DH2628	Interaction Design Methods	7.5 hp	Second cycle
DH2629	Interaction Design as a Reflective Practice	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DH2321	Information Visualization	6.0 hp	Second cycle
DH2400	Physical Interaction Design and Realization	7.5 hp	Second cycle
DH2408	Evaluation Methods in Human-Computer Interaction	6.0 hp	Second cycle
DH2413	Advanced Graphics and Interaction	9.0 hp	Second cycle
DH2632	Human-Computer Interaction, Research Seminars	3.0 hp	Second cycle
DH2642	Interaction Programming and the Dynamic Web	7.5 hp	Second cycle
DM2630	User Experience Design and Evaluation	9.0 hp	Second cycle
DT2140	Multimodal Interaction and Interfaces	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DM2518	Mobile Development with Web Technologies	7.5 hp	Second cycle

Supplementary information

At least 15 credits from the conditionally elective courses must be taken.

Subject to changes.

Year 2

Conditionally elective courses

Code	Name	Credits	Edu. level
DH2321	Information Visualization	6.0 hp	Second cycle
DH2400	Physical Interaction Design and Realization	7.5 hp	Second cycle
DH2408	Evaluation Methods in Human-Computer Interaction	6.0 hp	Second cycle
DH2413	Advanced Graphics and Interaction	9.0 hp	Second cycle
DH2632	Human-Computer Interaction, Research Seminars	3.0 hp	Second cycle
DH2642	Interaction Programming and the Dynamic Web	7.5 hp	Second cycle
DM2630	User Experience Design and Evaluation	9.0 hp	Second cycle
DT2140	Multimodal Interaction and Interfaces	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DM2518	Mobile Development with Web Technologies	7.5 hp	Second cycle

Supplementary information

At least 15 credits from the conditionally elective courses must be taken.

Subject to changes.

Track, Scientific Computing (CSSC)

Year 1

Mandatory courses (15.0 Credits)

Code	Name	Credits	Edu. level
DD2356	Methods in High Performance Computing	7.5 hp	Second cycle
DD2363	Methods in Scientific Computing	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2257	Visualization	7.5 hp	Second cycle
DD2365	Advanced Computation in Fluid Mechanics	7.5 hp	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
BB2280	Molecular Modeling	7.5 hp	Second cycle
DD2401	Neuroscience	7.5 hp	Second cycle
DD2402	Advanced Individual Course in Computational Biology	6.0 hp	Second cycle
DD2421	Machine Learning	7.5 hp	Second cycle
DD2435	Mathematical Modelling of Biological Systems	9.0 hp	Second cycle
DD2443	Parallel and Distributed Computing	7.5 hp	Second cycle
DH2320	Introduction to Visualization and Computer Graphics	6.0 hp	Second cycle
DT2212	Music Acoustics	7.5 hp	Second cycle
EL2820	Modelling of Dynamical Systems	7.5 hp	Second cycle
HL2008	Simulation Methods in Medical Engineering	7.5 hp	Second cycle
SF2561	The Finite Element Method	7.5 hp	Second cycle
SF2565	Program Construction in C++ for Scientific Computing	7.5 hp	Second cycle

Supplementary information

Conditionally elective courses (One of the courses must be taken):

DD2437 Artificial Neural Networks and Deep Architectures 7.5 credits

DD257 Visualization, 7.5 credits

DD2365 Advanced computation in fluid mechanics, 7.5 credits

Subject to changes.

Year 2

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
DD2444	Project Course in Scientific Computing	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2257	Visualization	7.5 hp	Second cycle
DD2365	Advanced Computation in Fluid Mechanics	7.5 hp	Second cycle
DD2437	Artificial Neural Networks and Deep Architectures	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
BB2280	Molecular Modeling	7.5 hp	Second cycle
DD2360	Applied GPU Programming	7.5 hp	Second cycle
DD2401	Neuroscience	7.5 hp	Second cycle
DD2402	Advanced Individual Course in Computational Biology	6.0 hp	Second cycle
DD2421	Machine Learning	7.5 hp	Second cycle
DD2435	Mathematical Modelling of Biological Systems	9.0 hp	Second cycle
DD2443	Parallel and Distributed Computing	7.5 hp	Second cycle
DH2320	Introduction to Visualization and Computer Graphics	6.0 hp	Second cycle
DT2212	Music Acoustics	7.5 hp	Second cycle
EL2820	Modelling of Dynamical Systems	7.5 hp	Second cycle
HL2008	Simulation Methods in Medical Engineering	7.5 hp	Second cycle
SF2561	The Finite Element Method	7.5 hp	Second cycle
SF2565	Program Construction in C++ for Scientific Computing	7.5 hp	Second cycle

Supplementary information

Conditionally elective courses (One of the courses must be taken):

DD2437 Artificial Neural Networks and Deep Architectures 7.5 credits

DD257 Visualization, 7.5 credits

DD2365 Advanced computation in fluid mechanics, 7.5 credits

Subject to changes.

Track, Software Technology (CSST)

Year 1

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
DD2480	Software Engineering Fundamentals	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2443	Parallel and Distributed Computing <i>Conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2448	Foundations of Cryptography <i>Compulsory for the subtrack Computer Security</i>	7.5 hp	Second cycle
DD2457	Program Semantics and Analysis <i>Conditionally elective for the subtrack Programming languages</i>	6.0 hp	Second cycle
DD2459	Software Reliability <i>Conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2460	Software Safety and Security <i>Conditionally elective for the subtrack Computer Security; Conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2481	Principles of Programming Languages <i>Compulsory for the subtrack Programming languages, conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2487	Large-Scale Software Development <i>Compulsory for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2488	Compiler Construction <i>Compulsory for the subtrack Programming languages</i>	9.0 hp	Second cycle
DD2496	Privacy Enhancing Technologies <i>Conditionally elective for the subtrack Computer Security</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD1389	Internet Programming	6.0 hp	First cycle
DD2421	Machine Learning	7.5 hp	Second cycle
DD2458	Problem Solving and Programming under Pressure	9.0 hp	Second cycle
DD2476	Search Engines and Information Retrieval Systems	9.0 hp	Second cycle
EP2500	Networked Systems Security <i>Computer Security</i>	7.5 hp	Second cycle

EP2510 Advanced Networked Systems Security <i>Computer Security</i>	7.5 hp	Second cycle
EP2520 Building Networked Systems Security <i>Computer Security</i>	7.5 hp	Second cycle
ID1217 Concurrent Programming	7.5 hp	First cycle

Supplementary information

Students studying the Software Technology track choose a subtrack consisting of mandatory and conditionally elective courses studied in year one and two

One of the following subtracks must be chosen:

1. Computer Security
2. Programming languages
3. Software Engineering

Subtrack Computer Security

Mandatory courses

DD2448 Foundations of Cryptography 7,5 hp

DD2497 Project course in system security, 7,5 hp (in year 2)

Conditionally elective courses (one of the courses must be taken):

DD2460 Software Safety and Security, 7.5 credits

DD2496 Privacy-Enhancing Technologies, 7.5 credits

Subtrack Programming languages:

Mandatory courses:

DD2481 Principles of Programming Languages, 7.5 credits

DD2488 Compiler Construction, 9,0 credits

Conditionally elective courses (one of the courses must be chosen):

DD2457 Program Semantics and Analysis 6,0 hp

DD2372 Automata and Languages, 6,0 credits

Subtrack Software Engineering

Mandatory courses

DD2487 Large-scale Software Development, 7,5 hp

Conditionally elective course (at least two courses must be taken):

DD2443 Parallel and Distributed Computing 7.5 credits

DD2459 Software Reliability, 7.5 credits

DD2460 Software Safety and Security, 7.5 credits

DD2481 Principles of Programming Languages, 7.5 credits

Subject to changes

Year 2

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2443	Parallel and Distributed Computing <i>Compulsory for the subtrack Programming languages</i>	7.5 hp	Second cycle
DD2448	Foundations of Cryptography <i>Compulsory for the subtrack Computer Security</i>	7.5 hp	Second cycle
DD2459	Software Reliability <i>Conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2460	Software Safety and Security <i>Conditionally elective for the subtrack Computer Security; Conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2481	Principles of Programming Languages <i>Compulsory for the subtrack Programming languages, conditionally elective for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2487	Large-Scale Software Development <i>Compulsory for the subtrack Software Engineering</i>	7.5 hp	Second cycle
DD2488	Compiler Construction <i>Compulsory for the subtrack Programming languages</i>	9.0 hp	Second cycle
DD2496	Privacy Enhancing Technologies <i>Conditionally elective for the subtrack Computer Security</i>	7.5 hp	Second cycle
DD2497	Project course in System Security <i>Compulsory for the subtrack Computer Security</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD1389	Internet Programming	6.0 hp	First cycle
DD2421	Machine Learning	7.5 hp	Second cycle
DD2458	Problem Solving and Programming under Pressure	9.0 hp	Second cycle

DD2476 Search Engines and Information Retrieval Systems	9.0 hp	Second cycle
EP2500 <u>Networked Systems Security</u> <i>Computer Security</i>	7.5 hp	Second cycle
EP2510 <u>Advanced Networked Systems Security</u> <i>Computer Security</i>	7.5 hp	Second cycle
EP2520 <u>Building Networked Systems Security</u> <i>Computer Security</i>	7.5 hp	Second cycle
ID1217 <u>Concurrent Programming</u>	7.5 hp	First cycle

Supplementary information

Students studying the Software Technology track choose a subtrack consisting of mandatory and conditionally elective courses studied in year one and two

One of the following subtracks must be chosen:

1. Computer Security
2. Programming languages
3. Software Engineering

Subtrack Computer Security

Mandatory courses

DD2448 Foundations of Cryptography 7,5 hp

DD2497 Project course in system security, 7,5 cr

Conditionally elective courses (one of the courses must be taken):

DD2460 Software Safety and Security, 7.5 credits

DD2496 Privacy-Enhancing Technologies, 7.5 credits

Subtrack Programming languages:

Mandatory courses:

DD2481 Principles of Programming Languages, 7.5 credits

DD2488 Compiler Construction, 9,0 credits

Conditionally elective courses (one of the courses must be chosen):

DD2457 Program Semantics and Analysis 6,0 hp

DD2372 Automata and Languages, 6,0 credits

Subtrack Software Engineering

Mandatory courses

DD2487 Large-scale Software Development, 7,5 hp

Conditionally elective course (at least two courses must be taken):

DD2443 Parallel and Distributed Computing 7.5 credits

DD2459 Software Reliability, 7.5 credits

DD2460 Software Safety and Security, 7.5 credits

DD2481 Principles of Programming Languages, 7.5 credits

Subject to changes

Track, Theoretical Computer Science (CSTC)

Year 1

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2442	Seminars on Theoretical Computer Science <i>Conditionally elective for the subtrack Algorithms, Complexity and Cryptography; Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2443	Parallel and Distributed Computing <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2448	Foundations of Cryptography <i>Compulsory for the subtrack Algorithms, Complexity and Cryptography; Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2452	Formal Methods <i>Compulsory for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2457	Program Semantics and Analysis <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	6.0 hp	Second cycle
DD2459	Software Reliability <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2460	Software Safety and Security <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
SF1677	Foundations of Analysis <i>Conditionally elective course in Mathematics</i>	7.5 hp	First cycle
SF2723	Topics in Mathematics III <i>Conditionally elective course in Mathematics</i>	7.5 hp	Second cycle
	Enumerative Combinatorics		Second

SF2741	<i>Conditionally elective course in Mathematics</i>	7.5 hp	cycle
SF2940	Probability Theory <i>Conditionally elective course in Mathematics</i>	7.5 hp	Second cycle
SF2955	Computer Intensive Methods in Mathematical Statistics <i>Conditionally elective course in Mathematics</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2447	Statistical Methods in Applied Computer Science	6.0 hp	Second cycle
DD2458	Problem Solving and Programming under Pressure	9.0 hp	Second cycle
ID1217	Concurrent Programming	7.5 hp	First cycle

Supplementary information

Students studying the Theoretical Computer Science track choose a subtrack consisting of mandatory and conditionally elective courses studied in year one and two.

One of the following subtracks must be chosen:

1. Algorithms, Complexity and Cryptography
2. Formal Methods and Semantics

Subtrack Algorithms, Complexity and Cryptography

Mandatory course, subtrack Algorithms, Complexity and Cryptography:

DD2448 Foundations of Cryptography, 7.5 credits

Conditionally elective courses, subtrack Algorithms, Complexity and Cryptography (at least one of the courses must be chosen):

DD2445 Complexity Theory, 7.5 credits

DD2442 Seminars on Theoretical Computer Science, 7.5 credits

Subtrack Formal Methods and Semantics:

Mandatory course, subtrack Formal Methods and Semantics:

DD2452 Formal Methods, 7.5 credits

Conditionally elective courses, subtrack Formal Methods and Semantics (at least one of the courses must be chosen):

DD2372 Automata and Languages, 6 credits

DD2442 Seminars on Theoretical Computer Science, 7.5 credits

DD2443 Parallel and Distributed Computing, 7.5 credits

DD2445 Complexity Theory, 7.5 credits

DD2448 Foundations of Cryptography, 7.5 credits

DD2457 Program Semantics and Analysis, 6 credits

DD2459 Software Reliability 7.5 credits

DD2460 Software Safety and Security, 7.5 credits

At least one of the following courses in Mathematics must be taken:

SF2700 Analysis, Basic Course 9.0 credits

SF2741 Enumerative Combinatorics 7,5 hp

SF2723 Topics in Mathematics III 7,5 hp

SF2724 Topics in Mathematics IV 7,5 hp

SF2730 Topics in Mathematics V 7,5 hp

SF2940 Probability Theory 7,5 hp

SF2972 Game theory 7,5 hp

Recommended elective courses:

Courses in more or less every field of mathematics, e.g., combinatorics, analysis, probability theory, optimization, logic, group theory, algebra, etc

Year 2

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
DD2467	Individual Project in Theoretical Computer Science	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2443	Parallel and Distributed Computing <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
	Foundations of Cryptography		Second

DD2448	<i>Compulsory for the subtrack Algorithms, Complexity and Cryptography; Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	cycle
DD2452	Formal Methods <i>Compulsory for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2459	Software Reliability <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
DD2460	Software Safety and Security <i>Conditionally elective for the subtrack Formal Methods and Semantics</i>	7.5 hp	Second cycle
SF2940	Probability Theory <i>Conditionally elective course in Mathematics</i>	7.5 hp	Second cycle
SF2972	Game Theory <i>Conditionally elective course in Mathematics</i>	7.5 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2447	Statistical Methods in Applied Computer Science	6.0 hp	Second cycle
ID1217	Concurrent Programming	7.5 hp	First cycle

Supplementary information

Students studying the Theoretical Computer Science track choose a subtrack consisting of mandatory and conditionally elective courses studied in year one and two.

One of the following subtracks must be chosen:

1. Algorithms, Complexity and Cryptography
2. Formal Methods and Semantics

Subtrack Algorithms, Complexity and Cryptography

Compulsory course, subtrack Algorithms, Complexity and Cryptography:

DD2448 Foundations of Cryptography, 7.5 credits

Conditionally elective courses, subtrack Algorithms, Complexity and Cryptography (at least one of the courses must be chosen):

DD2445 Complexity Theory, 7.5 credits

DD2442 Seminars on Theoretical Computer Science, 7.5 credits

Subtrack Formal Methods and Semantics:

Compulsory course, subtrack Formal Methods and Semantics:

DD2452 Formal Methods, 7.5 credits

Conditionally elective courses, subtract Formal Methods and Semantics (at least one of the courses must be chosen):

DD2372 Automata and Languages, 6 credits

DD2442 Seminars on Theoretical Computer Science, 7.5 credits

DD2443 Parallel and Distributed Computing, 7.5 credits

DD2445 Complexity Theory, 7.5 credits

DD2448 Foundations of Cryptography, 7.5 credits

DD2459 Software Reliability 7.5 credits

DD2460 Software Safety and Security, 7.5 credits

At least one of the following courses in Mathematics must be taken:

SF2700 Analysis, Basic Course 9.0 credits

SF2724 Topics in Mathematics IV 7,5 hp

SF2730 Topics in Mathematics V 7,5 hp

SF2940 Probability Theory 7,5 hp

SF2972 Game theory 7,5 hp

Recommended elective courses:

Courses in more or less every field of mathematics, e.g., combinatorics, analysis, probability theory, optimization, logic, group theory, algebra, etc

Track, Visualization and Interactive Graphics (CSVG)

Year 1

Mandatory courses (6.0 Credits)

Code	Name	Credits	Edu. level
DH2320	Introduction to Visualization and Computer Graphics	6.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2257	Visualization	7.5 hp	Second cycle
DH2321	Information Visualization	6.0 hp	Second cycle

DH2323 Computer Graphics and Interaction	6.0 hp	Second cycle
DH2413 Advanced Graphics and Interaction	9.0 hp	Second cycle
DH2650 Computer Game Design	6.0 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2356	Methods in High Performance Computing	7.5 hp	Second cycle
DD2423	Image Analysis and Computer Vision	7.5 hp	Second cycle
DD2424	Deep Learning in Data Science	7.5 hp	Second cycle
DD2429	Computational Photography	6.0 hp	Second cycle
DM2350	Human Perception for Information Technology	7.5 hp	Second cycle

Supplementary information

At least three courses must be taken from the conditionally elective courses.

Year 2

Mandatory courses (6.0 Credits)

Code	Name	Credits	Edu. level
DD2470	Advanced Topics in Visualization and Computer Graphics	6.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
DD2257	Visualization	7.5 hp	Second cycle
DH2321	Information Visualization	6.0 hp	Second cycle
DH2323	Computer Graphics and Interaction	6.0 hp	Second cycle
DH2413	Advanced Graphics and Interaction	9.0 hp	Second cycle
DH2650	Computer Game Design	6.0 hp	Second cycle

Recommended courses

Code	Name	Credits	Edu. level
DD2356	Methods in High Performance Computing	7.5 hp	Second cycle
DD2423	Image Analysis and Computer Vision	7.5 hp	Second cycle
DD2424	Deep Learning in Data Science	7.5 hp	Second cycle
DD2429	Computational Photography	6.0 hp	Second cycle
DM2350	Human Perception for Information Technology	7.5 hp	Second cycle

Supplementary information

Minst tre av de villkorligt valfria kurserna måste läsas



Appendix 2: Specialisations

Programme syllabus for studies starting in autumn 2018, Master's Programme, Computer Science, 120 credits (TCSCM)

Track, Cognitive Systems (CSCS)

The specialization in cognitive systems is about developing applications with artificial intelligence, ie, abilities traditionally associated with people. In the specialization you can choose to specialize towards robotics or towards speech and music.

Track, Data Science (CSDA)

Our society produce huge amounts of data. This specialization involves methods for managing and analyzing data from various sources, such as biomolecular sequence data, images and video, text,etc.

Track, Interaction Design (CSID)

Students learn to develop interactive systems with modern development methodology. The specialization also aims to provide deeper knowledge of how to systematically evaluate interactive systems.

Track, Scientific Computing (CSSC)

This specialization focuses on the techniques of mathematical modeling and numerical simulation of physical, chemical and biological systems. This can be the basis for virtual experiments that simulated crash tests, but also to build interactive virtual environments, for example, for computer games.

Track, Software Technology (CSST)

Software Engineering is about methods to create and maintain different types of software.

Track, Theoretical Computer Science (CSTC)

Theoretical Computer Science is about the abstract and mathematical methods to study algorithms. Students learn to use formal methods and focus on verifiable properties of software and software systems.

Track, Visualization and Interactive Graphics (CSVG)

This specialization stretches from basic visualization and graphics to modern research in the field. Visualization is mainly about making large and complex data understandable with the help of graphics, but has applications in computer games and other virtual environments.