



Doctoral programme — Computer Science

The programme description was approved by Fakultetsnämnden (Faculty Board) November 30, 2010. Valid from Spring 11.

Programme description (KTHDAT)

Programme name

Computer Science (Datalogi)

Subject area

The doctoral programme's overall purpose and learning outcomes

The aim for the education in the doctoral programme is to provide the student with good knowledge within the subject area and ability to carry out independent research, development, teaching and diagnostic work within different fields of the society. Additionally, the aim for the doctoral degree is to give the student ability to critically and independently plan, finance, initiate and lead such work.

The doctoral programme's size and recruitment

Calculated number of doctoral students in the programme is about 65 full time doctoral students, of which 10-15 are admitted each year.

Target groups for recruitment are masters of science in engineering and master students in computer science related subject areas, or the equivalent higher education qualification in some applied field of computer science, as e g biology, acoustics or computational linguistics.

Recruitment is done according to KTH's regulatory frameworks. Advertisement should take place four times annually, unless other rules are given by the financiers.

Funding

Funding of the doctoral programme, including its quality assurance procedures and doctoral positions, comes from direct government fundings for research and third-cycle programmes and external fundings for research, e g through participation in doctoral schools.

Courses

The courses within the doctoral programme are all offered within a third-cycle subject and are therefore presented in the study plan for the subject.

Quality enhancement activities

The programme is subject to a permanent improvement process through evaluations of courses, the students' progress and analyses of the adequacy of the supervision and the thesis.

Courses for third-cycle studies are evaluated according to CSC's and KTH's regulatory framework which implies that course analyses are prepared and are published after each course offering.

The progress of the doctoral students is monitored annually in the following ways:

- Each doctoral student writes a 'progress declaration' to be discussed with two academic staff, not the principal supervisor, to evaluate the quantity and quality in study progression and supervision.
- The individual study plan is revised and established by the principal supervisor, FA and PA.

In both course evaluations and the progress declaration, improvements to the doctoral programme may be suggested and should lead, through discussion in the programme council, to appropriate measures.

The programme council and programme co-ordinator should also follow the local and international discussion within the subject area, both that for general education for third-cycle studies, and continuously adapt the programme to the development. Discussion of the progress declaration can in addition lead to adjustments to the supervisor team for a doctoral student.

The quality of the thesis is evaluated in accordance with the publication standards that are described below and through discussion between the examining committee, supervisor and chairman at public defence of doctoral thesis.

The publication standard within computer science is not uniform due to cultural differences and since the field ranges from clean theory to salient applied research. Within large parts of computer science, publication at the best conferences often has higher impact than journal publications. A high-quality thesis may center around a single breakthrough result published in a first-tier journal or conference proceedings, or it may be based on a series of journal articles and/or conference publications where the research issues are gradually developed and solved.

All intermediate points on the scale between these two extremes occur. For monographs, equivalent publication activities should have occurred and publications on which the monograph is based should be referred to. The order of authors within the area is not stable (alphabetic order or one of the systems in which the authors' roles are apparent from the sequence of co-authors), which must be observed when assessing the effort of the author of the thesis.

National and international network

The curriculum is coordinated with neighbouring doctoral programmes at KTH, as well as with local and national doctoral schools. International doctoral schools ("summer schools") are organised in several topics within various international organisations. These schools are often appropriate to be included as an integrated part of doctoral students'syllabuses.

An extended visit to an internationally well-recognized research group with a relevant research profile is a natural part of doctoral students' studies and might be included in the study plans. Exchanges should exploit supervisors' contact networks, for example with MIT, Berkeley, ETH, Chalmers, Lausanne, TKK, RU and with other universities within the scope of "joint doctoral programmes" such as Erasmus Mundus.

The above is enumerated and defined in appendix 3.

Further instructions for registration

Appendixes

Appendix 1.1: Study plan for third-cycle subject Computer Science (DATALOGI).

Appendix 1.2: Study plan for third-cycle subject Speech and Music Communication (LJUDMUSI).

Appendix 2: List containing names and subject areas of supervisors within the programme

Appendix 3: Presentation of the programme's national and international network



Doctoral programme — Computer Science

Appendix 1.1: Study plan for third-cycle subject Computer Science (DATALOGI).

The subject plan was approved by Fakultetsnämnden (Faculty Board) November 30, 2010. Valid from Spring 11.

Subject title

Computer Science (Datalogi)

Subject description and programme outcomes

Scientific field

The computer science is the method science for design of software and other representations of calculations. The subject has a practical and a theoretical side.

Among the subareas of the computer science, the following can be mentioned

- development and analysis of fundamental computational algorithms
- analysis and classification of computational problems with respect to complexity
- artificial intelligence
- autonomous systems
- image processing and computer vision

- computational biology and bio-modelling
- computer security and cryptography
- graphical computing and communication human-machine
- Internet and grid technology
- modelling and analysis of computer-based systems
- neuron net modelling, neural calculations
- software engineering, semantics and programming languages
- applications within computational mathematics and computational logic

Description of possible specialisation

1. Computer Science

Specification of how the programme outcomes are to be achieved

Currently, the subject has no specialisations.

Computer Science

Description of the specialisation

Computers become all more common in the everyday life. Within computer science, the issue is which types of calculations that are possible to introduce in computer-based systems.

The issue can be tackled at a basic level where we look for general principles and fundamental borders for what is possible, but also based on a certain family of imagined application fields or be inspired by how living organisms may be functioning.

One of the reasons of study the field is to clarify the preconditions to create sustainable IT infrastructures in the society.

The application fields that are of current interest at KTH are biology, information systems, Internet technology, robot technology, seeing systems and language technology.

Current research

The research activity in computer science at KTH is in general organised in groups, where the parts of the subject that are stated above are studied. Considerable cooperation may exist between the groups and also with external interested parties.

A detailed description of the research in computer science can be found in the current development plan and the latest annual review for the research at the school of computer science and communication. The extent of the activities varies between the fields and also with time.

Programme structure

The education for third-cycle studies can lead to the Degree of Licentiate or Degree of Doctor.

The education, total 120 credits for Degree of Licentiate and 240 credits for Degree of Doctor, consists of coursework and thesis work. The coursework includes 60-90 credits for Degree of Doctor and 40-60 credits for Degree of Licentiate.

The thesis work thus corresponds to 150-180 credits for Degree of Doctor and 60-80 credits for Degree of Licentiate.

At admission, the doctoral student is assigned a principal supervisor and an assistant supervisor.

The assistant supervisor should have the doctoral degree and the principal supervisor should be Docent. They should have connection to KTH, and at least one of them should have KTH as main employer. At least one of the supervisors should have gone through supervisor education or of the faculty board been assessed to have equivalent skills. An individual study plan should be established and updated normally once a year, in consultations between doctoral student and supervisor. The established or revised study plan is established by the Director of Third-Cycle Education (FA) at KTH CSC. The study plan should convincingly show how the aims for the doctoral student's third-cycle studies can be achieved within available time.

Deviations from the stated points may be done if special circumstances apply.

Teaching of courses for third-cycle studies can be given in the form of lectures, seminars, literature courses and project assignments. The courses for each individual doctoral student are established individually in consultation with supervisors and are introduced in the study plan.

Doctoral students should under their education take part in and contribute to the scientific activity that is carried out at the school/KTH by attending seminars and give, normally, one seminar a year about their thesis.

Doctoral students are recommended to devote certain time (a maximum of 20 % of full-time) to teaching in first and second cycle courses. Such actions are financed by the first and second cycle education and should be included in the individual study plan.

Compulsory and recommended courses

In the coursework must be included elements of theory of knowledge and research methodology. In the coursework can also be included courses on teaching and learning in higher education. Such courses are however a requirement only if teaching in first and second cycle courses should take place during the studies.

An essential part of the courses (at least about 30 credits for Degree of Doctor) should be third-cycle courses in computer science and computer systems or correspond to computer science and engineering courses for the Master of Science in Engineering education in Computer science and engineering. The latter should be second cycle courses. At least 15 of these credits should lie outside the subject of the thesis.

In KTH's local Degree Ordinance for education for third-cycle studies is the level of courses in the coursework regulated: for Degree of Doctor, at least 60% of the credits should be third-cycle courses; for Degree of Licentiate 50%. For none of these higher education qualifications, any first-cycle course within the technology main field of study may be included. If these rules be deviated from, should the causes for this be stated in the individual study plan.

Other courses may be third-cycle courses or second-cycle courses at other programmes than the ones being stated in section 3.1, paragraphs 1 and 2, and in other subjects than computer science. The aim of these can be to give an advanced knowledge within applied computer science subjects and subjects that concern the thesis work, broadening to some application field or other skills, e g languages. Language courses should be at university level (first-cycle or second-cycle) and should not exceed 6 credits. Students admitted according to point 4 in section 3.1 below should choose bridging courses in computer science.

Thesis

The work with the thesis or the licentiate thesis should be started as soon as possible after the third-cycle studies have been started. The subject for the thesis should be chosen in consultation with the subject responsible person and principal supervisor, and should connect to the existing research at the department.

The thesis or the licentiate thesis is a compulsory part of the education for third-cycle studies. The education aims in this part that the student should develop an ability to give independent contributions to the research and also an ability to scientific cooperation, within and outside the own subject. The thesis or the licentiate thesis should contain new research results that the student has developed alone or in collaboration with others. The scientific main results should satisfy the quality requirements for publication in internationally recognised magazines with referee systems. The student's contributions to in the thesis included texts that have several authors should be able to be distinguished.

The thesis or the licentiate thesis should normally be written in English. It can either be designed as a compilation of scientific articles or as a monograph thesis. In the previous case, there should be a

dedicated written summary. Irrespective of if the thesis is intended to become a monograph or compilation thesis, international publication of achieved results should be sought during the doctoral studies.

Entry requirements and selection

General and special admission requirements and prior knowledge

Entry requirements for third-cycle studies are that the applicant satisfy both general entry requirements and specific entry requirements and has such ability in other respects that is needed to fulfill the education.

Selection rules and procedures

The selection is made among the applicants that satisfy the entry requirements. At the selection, the grade of the applicant's maturity, ability to independent assessment and critical analysis constitute important aspects. Strong emphasis is placed at learning outcomes in advanced courses or in the form of individual projects such as the degree project.

The programme's degrees and examinations

Degree of Licentiate and Degree of Doctor (PhD)

Degree of Licentiate and Degree of Doctor are to be taken in accordance with KTH's general rules.

These imply for example that the thesis should be examined at public defence of doctoral thesis (Degree of Doctor) or licentiate seminar (Degree of Licentiate).

The programme's examinations

No other compulsory tests are included in the education.



Doctoral programme — Computer Science

Appendix 1.2: Study plan for third-cycle subject Speech and Music Communication (LJUDMUSI).

The subject plan was approved by Fakultetsnämnden (Faculty Board) November 30, 2010. Valid from Spring 11.

Subject title

Speech and Music Communication (tal- och musikkommunikation)

Subject description and programme outcomes

Scientific field

The subject Speech and music communication encompasses scientific studies of human communication primarily by means of acoustic signals such as speech or music. Also communication by means of visual signals, for example facial gestures and body movements during speech or music, is included in the subject. The field includes descriptions, theories, models and technical systems covering all aspects of the communication chain from production, acoustic transfer, and transformation via hearing to perception, understanding and experience.

Description of possible specialisation

1. Speech communication
2. Music acoustics

Specification of how the programme outcomes are to be achieved

Speech communication

Description of the specialisation

Speech communication encompasses the theory of speech communication processes and applications within information technology, telecommunications and also within a number of medical specialities and aids for the handicapped.

Current research

Speech technology that includes applications of speech communication is under fast development and has grown to a new interdisciplinary research domain with his roots mainly in linguistics, speech communication research and computer science. Examples of research areas are: multi-modal speech synthesis, automatic speech recognition, speaker verification, multi-modal dialogue systems and more application-oriented systems and methods related to e.g. language learning and different disabilities. Any one of these areas comprises a suitable subject for a thesis. Thesis related research is often associated with the Centre for Speech Technology (CTT), a competence centre for cooperation between academia and industry. Basic research in speech production, acoustics of speech, speech perception and analysis of voice quality is also carried out at the department and can constitute a suitable thesis subject.

Programme structure

The education can be completed with Degree of Licentiate or Degree of Doctor. Education for third-cycle studies comprising a total of 120 credits for Degree of Licentiate and 240 credits for Degree of Doctor consists of coursework and thesis work. The coursework includes for Degree of Licentiate 35-50 credits and for Degree of Doctor 60-90 credits. KTH's local regulations for education for third-cycle studies regulate how first-cycle courses may be included in the degree. The reason for any individual deviations to these regulations must be specified in the individual study plan. Courses for first-cycle studies can only be included if these are essential for the individual thesis subject or give an interdisciplinary expansion of the research area. Deviation from the suggested number of

credits can occur in the case of extraordinary circumstances. Courses for third-cycle studies can be given in the form of lectures, seminars, reading assignments and project assignments. The courses for each individual doctoral student are established individually in consultation with the head of the subject area and the principal supervisor. An individual study plan should be established and updated normally once a year. The study plan should convincingly show how the aims for the doctoral student's third-cycle studies can be achieved within available time. Doctoral students should, during their education, take part in and contribute to the scientific activity that is carried out at the department by attending seminars and give normally a seminar a year about their thesis work.

Compulsory and recommended courses

In the coursework must be included elements of theory of knowledge and research methodology. In the coursework may be included courses with a specialisation in teaching and learning in higher education. Such courses are, however, a requirement if teaching within the first and second cycle education should take place during the studies.

The courses Basics of Speech and Hearing (F2F5113) and Theory of Speech Communication (F2F5115) are compulsory for both licentiate and doctoral students. Other courses are defined and chosen individually. Some of these courses are described below.

Due to the interdisciplinary nature on the studies, doctoral and undergraduate courses at other universities can be included in the coursework. Especially courses in Phonetics and Linguistics can often be a good complement to the courses in Speech Communication.

Compulsory courses

F2F5113 Basics of Speech and Hearing, 15 credits.

Basics of speech and hearing Physiology of speech and hearing. Signal structures in different parts of the human speaker/listener speech chain. Coding mechanisms.

F2F5115 Theory of Speech Communication, 15 credits.

Theory of speech communication. Information theory, linguistics and phonetics as theoretical ground for speech communication. The speech code. Special emphasis is placed on such aspects of speech communication which have particular importance for automatic speech understanding and speech synthesis.

Courses recommended optional

F2F5112 Special Course in Signal and Circuit Theory, 15 credits.

Special course in signal and circuit theory. Signal processing methods for speech analysis and speech recognition. Models for speech production by means of for example transmission lines.

F2F5114 Advanced Course in Speech and Hearing, 7.5-22.5 credits.

Advanced course in speech and hearing. Problems with complexity and variability.

Interaction. Auditory transformations in relation to the speech code.

F2F5116 Advanced Course in Speech Communication Theory, 7.5-22.5 credits.

Advanced course in speech communication theory. Text analysis, parsing, problems with lexical access. Relationships between prosodic and segmental features. Speaker-specific features and speaking style variations.

F2F5117 Speech Communication Systems, 15 credits.

Speech communication systems. The use of speech communication models in speech technology systems, e.g. speech-based dialogue systems. Design criteria and performance. Evaluation of speech intelligibility and speech quality Effect of room acoustics and limitations in the ability of the speaker /listener Speech based dialogue systems. Applications within for example information technology, telecommunications, education and aids for the handicapped.

Thesis

The work with the thesis or the licentiate thesis should be started as soon as possible after the third-cycle studies have been started. The subject for the thesis should be chosen in consultation with the head of the subject area and principal supervisor, and should connect to the ongoing research at the department.

The thesis or the licentiate thesis is a compulsory part of the education for third-cycle studies. This part of the education aims at developing the student's ability to give independent contributions to research and cooperating to scientific studies within and outside his/her own subject. The thesis or the licentiate thesis should contain new research results that the student has developed alone or in collaboration with others. The main scientific results should satisfy the quality requirements for publication in internationally recognised journals using a peer review system. The student's own contribution to texts in a thesis having several authors shall be separately defined

The thesis or the licentiate thesis should normally be written in English. It can either be designed as a compilation of scientific articles or as a monograph thesis. In the previous case, there should be a dedicated written summary.

Irrespective of if the thesis is intended to become a monograph or compilation thesis, international publication of achieved results should be sought during the doctoral studies.

Music acoustics

Description of the specialisation

Music acoustics encompasses theories of the musical communication process: composer- musicians- listeners.

Current research

Research and related applications lie primarily within the following areas: music instrument analysis and design, vocology, music informatics, music technology, audio reproduction, nonverbal communication through sound, and music and voice pedagogy. Central subjects comprise theories for sound generation in musical instruments (including the singing voice) and models of music perception.

The structuring of sound sequences on several levels in the music communication chain is another important subject area. Music acoustics is therefore a strong interdisciplinary subject.

The education for third-cycle studies should further lead to a deepened understanding of music as both an acoustic and psychological phenomenon.

Programme structure

The education can be completed with Degree of Licentiate or Degree of Doctor. The coursework includes for Degree of Licentiate 35-50 credits and for Degree of Doctor 60-90 credits.

KTH's local regulations for education for third-cycle studies regulate how first-cycle courses may be included in the degree. The reason for any individual deviations to these regulations must be specified in the individual study plan. Courses for third-cycle studies can be given in the form of lectures, seminars, reading assignments and project assignments. Independent literature studies comprise the most important part of the course work and are to be chosen individually in consultation with the supervisor.

An individual study plan should be established and updated normally once a year. The study plan should convincingly show how the aims for the doctoral student's third-cycle studies can be achieved within available time.

Doctoral students should, during their education, take part in and contribute to the scientific activity that is carried out at the department by attending seminars and give normally a seminar a year about their thesis work.

Compulsory and recommended courses

In the coursework must be included elements of theory of knowledge and research methodology. In the coursework may be included courses with a specialisation in teaching and learning in higher education. Such courses are, however, a requirement if teaching within the first and second cycle education should take place during the studies.

The courses Acoustics (F2F5210), Auditory Perception (F2F5211) and Room Acoustics (F2F5205) are compulsory for both licentiate students and doctoral students. Other courses are defined and chosen individually.

Compulsory courses

F2F5210 Acoustics 7.5-15 credits.

The main fields of study of the classical acoustics: the wave equation, oscillations in strings, pipes, membranes, rods and plates.

F2F5211 Auditory Perception 7.5-30 credits.

Physiology of hearing, perception, the representation of signals in the peripheral auditory system, binaural hearing and localisation.

F2F5205 Room Acoustics 7.5 credits.

Sound fields in rooms, ray tracing, wave-theoretical and statistical models.

Optional courses

F2F5212 Instrument acoustics 7.5-30 credits.

The science about the acoustic function of the most common instruments: excitation principles, feedback in resonator systems, radiation properties.

F2F5214 Musicology 7.5-15 credits.

Fundamentals of harmony, counterpoint and elementary composition. Also other optional courses can occur.

FDT3230 Statistical methods for the behavioural science 7.5-10 credits.

Basic statistics, categorical data, tests of means, correlation and regression, analysis of variance, multiple regression.

Thesis

The work with the thesis or the licentiate thesis should be started as soon as possible after the third-cycle studies have been started. The subject for the thesis should be chosen in consultation with the subject responsible person and principal supervisor, and should connect to the existing research at the department.

The thesis or the licentiate thesis is a compulsory part of the education for third-cycle studies. This part of the education aims at developing the student's ability to give independent contributions to research and cooperating to scientific studies within and outside his/her own subject. The thesis or the licentiate thesis should contain new research results that the student has developed alone or in collaboration with others. The main scientific results should satisfy the quality requirements for publication in internationally recognised journals using a peer review system. The student's own contribution to texts in a thesis having several authors shall be separately defined. The thesis or the licentiate thesis should normally be written in English. It can either be designed as a compilation of

scientific articles or as a monograph thesis. In the previous case, there should be a dedicated written summary. Irrespective of if the thesis is intended to become a monograph or compilation thesis, international publication of achieved results should be sought during the doctoral studies.

Entry requirements and selection

General and special admission requirements and prior knowledge

General entry requirements are defined by general regulations established by National the Agency for Higher Education and KTH centrally.

Selection rules and procedures

The selection is made among the applicants who satisfy the entry requirements. At the selection, the grade of the applicant's maturity, ability to independent assessment and critical analysis constitute important aspects. Strong emphasis is placed at learning outcomes in advanced courses or in the form of individual projects such as the degree project. Furthermore, the head of the subject or a selected teacher should have accepted the responsibility as supervisor for the student.

The programme's degrees and examinations

Degree of Licentiate and Degree of Doctor (PhD)

Degree of Licentiate and Degree of Doctor are to be taken in accordance with KTH's general rules.

The programme's examinations

No other compulsory tests are included in the education.



Doctoral programme — Computer Science

Appendix 2: List containing names and subject areas of supervisors within the programme

The programme description was approved by Fakultetsnämnden (Faculty Board) November 30, 2010. Valid from Spring 11.



Doctoral programme — Computer Science

Appendix 3: Presentation of the programme's national and international network

The programme description was approved by Fakultetsnämnden (Faculty Board) November 30, 2010. Valid from Spring 11.