Department of Computer Science

STUDY GUIDE 2010-2012

1 CONTACT INFORMATION

Department of Computer Science

Exactum (Kumpula campus)
PO Box 68 (Gustaf Hällströmin katu 2b)
00014 University of Helsinki
Telephone 1911 (switchboard), direct numbers 191 + extension number
Web pages: http://www.cs.helsinki.fi/

Head of department

Professor Esko Ukkonen, office hours Wed 13–14 in D240b, 2nd floor.

Department office

Room D239, 2nd floor, phone 191 51123), open for students Mon-Fri 12-14 or by appointment per e-mail (toimisto@cs.helsinki.fi).

Student counselling

Room A232, 2nd floor, phone 191 51121. The office hours for each term are listed on the web page http://www.cs.helsinki.fi/en/studies/study-counselling. E-mail to student advisors: opintoneuvonta@cs.helsinki.fi.

Head of Studies

Jaakko Kurhila, office hours Tue 13-14 and Thu 14-15 and by appointment in office D240a, 2nd floor.

Web information, e-mail

The department uses its web pages to inform both about permanent matters and current events. The department homepage is at http://www.cs.helsinki.fi/en/home and the information most pertinent to students is on the Studies page http://www.cs.helsinki.fi/en/studies. There are instructions on how students can join their mailing list on the Studies web page. For e-mail to the department, we recommend the use of the service addresses

- atk-apu@cs.helsinki.fi guidance and help with the department's computers and systems
- tktl-luvat@cs.helsinki.fi user accounts for the department systems

- opetus@cs.helsinki.fi practical teaching arrangements
- hyvaksiluvut@cs.helsinki.fi recognition of credits gained elsewhere
- johtaja@cs.helsinki.fi head of department
- toimisto@cs.helsinki.fi department office
- opintoneuvonta@cs.helsinki.fi student counselling
- opintoesimies@cs.helsinki.fi head of studies

There is a more detailed list on the page http://www.cs.helsinki.fi/en/studies/service-addresses-studies-administration.

Library

Please see Kumpula Science Library at http://www.helsinki.fi/kirjasto/kumpula/.

2 GENERAL INFORMATION ON STUDYING COMPUTER SCIENCE

Computer science as a science and a field of study

Computer science studies algorithm-based methods and processes, with which information is described and modified; their theory, analysis, design, implementation, and applications. Such methods can be implemented as computer programs that a computer can run 'automatically.' The basic question in computer science is: 'what can be done automatically and how can it be done efficiently?' This characterisation clearly shows that, apart from being an exact method science, computer science is also a constructive and experimental science, where various testing arrangements play a significant role.

The swift development of information technology has made the ICT field one of the most important sectors in our society, the functions of which are increasingly based on IT systems. Today, computing is an inherent part of most areas of business, administration, research, and teaching, making IT skills a key to success in these fields. In a short time, the field of computing has become our national strength.

In the past few years, IT development has created new application fields, with computer science at their methodical core. Examples of such application fields include bioinformatics, combining biology and computer science; geoinformatics from geography and computer science; and computational science, which has arisen to answer the needs of many disciplines (such as physics, chemistry, ecology, medicine, behavioural sciences, sociology, national economics).

Computer science studies are an excellent basis for any kind of work involving the development or application of information technology. In addition to professionals in computing, the job market needs people with good basic computer science skills in addition to their own field of expertise. This means

that, instead of taking computer science as your major subject, you can take one of the application fields as your major and a strong minor in computer science. There are also multi-disciplinary Master's programmes where you can acquire the versatile skills for employment in modern fields like bioinformatics.

Most graduates in computer science find work as IT specialists in business or administration, innovative development of IT and telecommunications, as well as in ICT teaching and research. For those interested in research and development (R&D), computer science is a swiftly evolving science to be reckoned with: the research in this field offers challenging and significant problems, with solutions that often have immediate applications with a strong impact.

Degrees, sub-programmes, and Master's programmes

The basic degrees of the computer science curriculum are the Bachelor of Science (BSc, 180 credits) and Master of Science (MSc, 120 credits) degrees. The major subject of the Bachelor's and Master's degrees is computer science. For the Bachelor's degree, the contents of the major subject are uniform, while students at the Master's level can choose between three sub-programmes. Two of these programmes are given fully in English, namely, the programme on Algorithms and Machine Learning and the programme on Networking and Services.

There are two other Master's programmes at the department: Master’s Degree Programme in Bioinformatics (MBI), and International CBU Master’s Degree Programme in Information and Communication Technology (CBU-ICT). The Master's programmes are carried out in cooperation with other departments and universities, and students have to apply separately for them. The contents of the MBI programme are multidisciplinary with methods in computer science and statistics, along with their application in biology and medicine. In the CBU-ICT programme, students also take courses in other Finnish and/or Russian universities that are part of the programme. There is a separate description of the Master's programmes in the Study Guide (available on the web pages of the Faculty of Science).

If you are a full-time student, you can complete the BSc degree in three years and then the MSc degree in two. The postgraduate degrees in computer science are the Licentiate (PhLic) and the Doctoral (PhD) degrees. Please see the degree requirements for a detailed structure of the degrees.

Computer science studies at the Bachelor's level start with the basic module (25 credits) and continue to the intermediate module (63 cr). Students are supported in their scheduling through the LuK-HOPS tutoring that is carried on the whole BSC programme from start to finish, and that each student must sign up for from the start of their first term. The basic and intermediate modules for the BSc degree include courses in topics from all the specialisation areas of the sub-

programmes. In order to take the MSc degree, you must complete the BSc degree first. After completing the BSc degree, to take the MSc degree you will complete the advanced module (80 cr) in your major subject. The MSc degree is geared towards education for a career as a specialist, in R&D and management, or research in this field, and students specialise by completing one of the sub-programmes (or Master's programmes) in accordance with the requirements. The sub-programmes have their own web pages where they detail what courses are suitable elective courses for their advanced module and how to negotiate a combination of courses that may not be in their curriculum.

The sub-programmes in computer science are: algorithms and machine learning; networking and services; and software systems. For the MSc degree, you can enter one of the sub-programmes simply by taking the courses mentioned in the degree requirements for each sub-programme. In practice, you can select a sub-programme by registering with the tutor for that sub-programme to start making your study plan ('FM-HOPS') at the end of your BSc programme or, at the very latest, at the start of your MSc programme.

Students who have been accepted directly for the MSc programme on the basis of a previous degree done somewhere else do not have to take the BSc degree. They should find out whether they need to take complementary courses before starting the sub-programme. The sub-programme tutor will be able to help with this. If you are not sure about which sub-programme to follow, you should discuss your study plan and which tutor to contact with the student counsellor as soon as possible.

The focus of the algorithms and machine learning sub-programme is on theories and applications of algorithms and artificial intelligence, finding efficient algorithms especially for intelligent systems, and the application of these algorithms on biological and other data. In the networking and services sub-programme, the focus is on the structures, implementations, efficiency, and correctness of the different parts of distributed systems and communication methods. The software systems sub-programme studies the systematic production of large and complex software systems with the goal to educate specialists in software and information management as well as leaders for development projects.

The research school

Students in the so-called research school at the department are often geared towards scientific research in computer science and a postgraduate degree, but it also offers a channel into other challenging special missions in computer science.

The degree requirements for the research school are the same as for others. The purpose of the school is to help students direct their curriculum in a sensible way

career-wise, by e.g. creating a dialogue between students and the research groups at the department (including presentations of research groups, traineeships, more challenging exercises in connection with the research at the department), The degree of involvement shown by the students themselves is the most significant factor for students in the research school. At the later stages of the Master's programme, some of the students will be invited to join research groups or a graduate school (Hecse, FICS, FIGS, SoSE).

Annually, 5-10 students are selected for the research school in May. The choice is based on study success and an interview. Students who have made good progress in their studies can also apply to the school later than the spring of their first year.

Student counselling

There is information about the department, teaching, and research groups on the department's website and notice boards.

The most important information about studying at the department is available on the Studies web page at http://www.cs.helsinki.fi/en/studies. The most up-to-date information about teaching is available in the teaching programme for each term, published before the start of the term on the department's website. The learning goals, contents, and requirements for each course are presented on the course description pages.

Personal student counselling is given by each student's own HOPS tutor at the BSc stage, and by the student counsellors. Counselling for the MSc programmes and postgraduate studies is given by the tutors for the sub-programmes and the professors in charge of them, during their office hours (as well as the student counsellors). Information about any single course is given by the teacher of the course.

Important dates

The most important dates for students during the academic years 2010-2011 and 2011-2012 are listed in the annual clock on the Studies page.

There is an information meeting for first-year undergraduates majoring in computer science before the start of the term.

The teaching periods during academic year 2010-2011 are:

I	6 Sept–24 Oct 2010
II	1 Nov–19 Dec 2010
III	17 Jan–6 March 2011
IV	14 March–22 May 2011 *)

The teaching periods during academic year 2011-2012 are:

I 5 Sept–23 Oct 2011
II 31 Oct–18 Dec 2011
III 16 Jan–4 March 2012
IV 12 March–20 May 2012 *)

*) Period IV includes the Easter week as well as the two-week term for intensive courses at the end of the period; the normal teaching lasts as long in this period as during other periods.

Registration for software engineering projects, scientific writing, and seminars in spring 2011 and 2012: 10–25 Nov 2010 and 9–24 Nov 2011

Registration for autumn 2011 and 2012 software engineering projects, scientific writing and seminars: 11–26 May 2011 and 9–24 May 2012.

Registration for summer 2011 and 2012 software engineering projects: 1–20 Apr 2011 and 3–29 Apr 2012.

3 DEGREE REQUIREMENTS

Since it is a swiftly developing field, the degree requirements for computer science are frequently updated. The new degree requirements in this guide will come into force on 1 August 2010 and differ from the requirements of 2005-2008 and 2008-2010.

Students entering the university in academic year 2010-2011 will follow these new requirements. Students who have started before 1 August 2010 can follow the requirements of their freshman year or later degree requirements. Keep in mind that the degree requirements of 2005-2008 will only be in force until 31 July 2011, both for the Bachelor's and Master's degrees. The degree requirements for 2005-2008 and 2008-2010 are available in the old study guides and via the department's Studies web page.

BACHELOR OF SCIENCE DEGREE (180 CR)

1. Major subject studies

584111 BASIC MODULE (25 CR)

- 582102 Johdatus tietojenkäsittelytieteeseen (Introduction to computer science), 4 cr,
- 581325 Ohjelmoinnin perusteet (Introduction to programming), 5 cr
- 582103 Ohjelmoinnin jatkokurssi (Advanced course in programming), 4 cr
- 582104 Ohjelmistojen mallintaminen (Modelling of software), 4 cr
- 58160 Ohjelmoinnin harjoitustyö (Programming project), 4 cr

- 581328 Tietokantojen perusteet (Introduction to databases), 4 cr

584213 INTERMEDIATE MODULE (63 CR)

- 58131 Tietorakenteet (Data structures), 8 cr
- 58161 Tietorakenteiden harjoitustyö (Data-structure project), 4 cr
- 582203 Tietokantasovellus (Database application), 4 cr
- 581305 Tietokoneen toiminta (Computer organization), 4 cr
- 582202 Tietoliikenteen perusteet (Introduction to data communications), 4 cr
- 581332 Rinnakkaisohjelmointi (Parallel programming), 6 cr
- 582206 Laskennan mallit (Computation models), 6 cr
- 582215 Tietoturvan perusteet (Introduction to security), 4 cr
- 582216 Johdatus tekoälyyn (Introduction to artificial intelligence), 4 cr
- 581259 Ohjelmistotuotanto (Software engineering), 4 cr
- 581260 Ohjelmistotuotantoprojekti (Software engineering project), 9 cr
- 582204 Bachelor's thesis, 6 cr
- 50036 Maturity test, 0 cr

2. Minor subject studies (50 cr)

- The basic module, 25 cr, in mathematics or method sciences and the basic module, 25 cr, in another minor subject.

  OR

- Modules in mathematics or method sciences, 50 cr.

In all the above cases, there have to be at least 10 cr of mathematics and 10 cr of statistics in the method sciences module. In all cases, the minor subject courses should include the mathematics course Introduction to discrete mathematics.

3. Other studies

- Language courses, 10 cr
  - 582505 Communication in home language, 3 cr
  - Second domestic language, 3 cr
  - Foreign language, 4 cr

- 584401 Information and communication technology, 5 cr
  - 582514 ICT driving license, 3 cr
  - 581324 Tietokone työvälineenä (Introduction to the use of computers), 1 cr
  - 582506 Tutkimustiedonhaku (Seeking research information), 1 cr

- 584402 Traineeship or vocational orientation, 1-3 cr
  - 582508 Vocational orientation in connection with software engineering project, 1 cr,
    or
  - 582509 Professional work experience in IT field, 2 cr

- 582507 Personal study plan and participation in teacher tutorial (LuK-HOPS), 2 cr

- 582513 Opiskelutekniikka (Techniques for studying), 2 cr

Optional/elective courses to fill the requirements of 180 credits. These courses can be major or minor subject or other courses.

MASTER OF SCIENCE DEGREE (120 CR)

There are three sub-programmes for the Master's degree in computer science:

- Algorithms and Machine Learning (Algoritmit ja koneoppiminen)
- Networking and Services (Hajautetut järjestelmät ja tietoliikenne)
- Ohjelmistojärjestelmät (Software systems, in Finnish only)

In addition, there are two Master's programmes given in English at the department:

- Master's Degree Programme in Bioinformatics
- International CBU Master's Degree Programme in Information and Communication Technology

Their requirements are presented separately (available on the web page of the Faculty of Science or the web pages of the programme).

The syllabus for the Master's degree in computer science varies according to sub-programme, though adhering to the following structure on the whole:

1. Major subject studies

INTERMEDIATE MODULE

For the sub-programmes Networking and Services and Software Systems, there are some required intermediate courses that can be taken either as part of the Bachelor's degree or in addition to the advanced courses for the Master's degree.

ADVANCED MODULE (80 cr)

- Compulsory courses for each sub-programme, 8 cr
- Elective advanced courses suitable for the sub-programme (other than

seminars), 26 cr
- Seminars, 6 cr
- 50131 Master's thesis (Pro gradu), 40 cr
- 50039 Maturity test

2. Minor subject studies

For the sub-programme Algorithms and Machine Learning, a total of 60 credits of mathematics or method science modules have to be included in the BSc and MSc degrees.

3. Other studies

- 582510 Personal study plan (FM-HOPS), 1 cr
- 582517 Orientation to MSc Studies, 2 cr, for students who are only taking the MSc degree at the department.
- English language, 0-4 cr, in accordance with the personal study plan (FM-HOPS) approved by the department.
- 584403 Advanced traineeship or vocational orientation, at least 2 cr
  - 582511 Advanced professional work experience in IT field 2-6 cr
    or
  - 582516 Software Factory Work Experience, 7 cr
    or
  - 582515 The field of information technology as a profession, 2 cr

Optional courses to fill the requirements of 120 credits. These courses can be major, minor or other subject courses.

SUB-PROGRAMME DEGREE REQUIREMENTS

Algorithms and Machine Learning (Algoritmit ja koneoppiminen)

1. Major subject studies

584333 ADVANCED MODULE

- Compulsory courses, 8 cr
  - 582630 Design and Analysis of Algorithms, 4 cr
  - 582631 Introduction to Machine Learning, 4 cr
- Elective courses, 26 cr
  - At least one of the following combinations:
    - 58093 String Processing Algorithms, 4 cr and
    - 582668 Project in String Processing Algorithms, 2 cr,
      or
    - 582634 Data Mining, 4 cr and
    - 582635 Data Mining Project, 2 cr,

or
        - 582636 Probabilistic Models, 4 cr and
        - 582637 Project in Probabilistic Models, 2 cr
    - Advanced courses in computer science (other than seminars) 20 credits in accordance with the instructions on the sub-programme's web page.
- Seminars, 6 cr
- 50131 Master's thesis (Pro gradu), 40 cr
- 50039 Maturity test

2. Minor subject studies

A total of 60 credits of mathematics or method science modules included in the BSc and MSc degrees together. The method science module must include at least 10 cr of mathematics and 10 cr of statistics.

Networking and Services (Hajautetut järjestelmät ja tietoliikenne)

1. Major subject courses

INTERMEDIATE MODULE

- 58127 C-ohjelmointi (Programming in C), 4 cr and
- 582640 Käyttöjärjestelmät (Operating Systems), 4 cr (unless included in previous degree)

584334 ADVANCED MODULE

- Compulsory courses, 8 cr
    - 582417 Distributed Systems, 4 cr
    - 582665 Distributed Systems Project, 4 cr
- Elective courses, 26 cr
    - At least one of the following:
        - 582641 Collaboration of Autonomous Business Services, 4 cr
        - 582498 Internet protocols, 4 cr
        - 582615 Overlay and P2P Networks, 4 cr
    - Advanced courses in computer science (other than seminars) 22 credits in accordance with the instructions on the sub-programme's web page.
- Seminars, 6 cr
- 50131 Master's thesis (Pro gradu), 40 cr
- 50039 Maturity test

2. Minor subject studies

There are no specific minor subject requirements in this sub-programme.

Ohjelmistojärjestelmät (software systems, in Finnish only)

1. Major subject studies

INTERMEDIATE MODULE

- 582482 Tietokannan suunnittelu (Database design), 4 cr (unless included in previous degree)

584335 ADVANCED MODULE

- Compulsory courses, 8 cr
  - 581358 Ohjelmistoarkkitehtuurit (Software architecture), 5 cr
  - 582663 Ohjelmistoarkkitehtuurien harjoitustyö (Software architecture project), 3 cr
- Elective courses, 26 cr
  - At least one of the following:
    - 581359 Ohjelmistoprosessit ja ohjelmistojen laatu Software processes and quality), 4 cr
    - 582642 Palvelusuuntautunut ohjelmistotuotanto (Service-orientated software engineering), 4 cr
    - 582490 Transaktioiden hallinta (Transaction management), 4 cr
  - Advanced courses in computer science (other than seminars) 22 credits in accordance with the instructions on the sub-programme's web page.
- Seminars, 6 cr
- 50131 Master's thesis (Pro gradu), 40 cr
- 50039 Maturity test

2. Minor subject studies

There are no specific minor subject requirements in this sub-programme.

POSTGRADUATE DEGREES

LICENTIATE OF PHILOSOPHY DEGREE

1. 58090 Postgraduate courses in computer science, 60 cr (details the same as the requirements for the PhD degree)

2. Licentiate thesis.

DOCTOR OF PHILOSOPHY DEGREE

1. 58090 Postgraduate courses in computer science, 60 cr
   - 58271 Courses in research field, 50 cr
     - 582710 Postgraduate seminar, 6 cr

    - Other contents to be detailed in the study plan.
- 58272 General postgraduate courses, 10 cr
    - The general postgraduate courses must include courses in science philosophy (582720), research ethics (582721) and general training to act as expert (582722), as well as international research (582723). Contents and ways to carry them out are to be detailed in the study plan.

2. Doctoral thesis.

Students who have completed some other degree than a Master's degree in computer science may have to incorporate more courses than 60 cr worth in their study plan.

COMPUTER SCIENCE FOR MINORING STUDENTS

584112 BASIC MODULE (MINOR SUBJECT) (25 CR)

- 581325 Ohjelmoinnin perusteet (Introduction to programming), 5 cr
- 582104 Ohjelmistojen mallintaminen (Modelling of software), 4 cr
- One of the following alternatives:
    - 582103 Ohjelmoinnin jatkokurssi (Advanced course in programming), 4 cr (or another equivalent programming course) and
    - 58160 Ohjelmoinnin harjoitustyö (Programming project), 4 cr
      or
    - 581328 Tietokantojen perusteet Introduction to databases), 4 cr and
    - 582203 Tietokantasovellus (Database application), 4 cr
- Elective computer science basic or intermediate courses, 8 cr

584214 INTERMEDIATE MODULE (MINOR SUBJECT) (35 CR)

- Compulsory intermediate major-subject courses in comp. science, 12 cr
- Optional basic or intermediate computer science courses, 23 cr

The software engineering project or the Bachelor's thesis cannot be included in minor subject studies.

584327 ADVANCED MODULE (MINOR SUBJECT) (60 CR)

The advanced module in computer science is completed by following the syllabus of one of the sub-programmes, and students always have to agree on the module contents with the professor in charge of the sub-programme. In general, they follow the same structure:

- Advanced courses in computer science (37 cr)
- Seminars, 3 cr
- 584332 Minor subject thesis in computer science, 20 cr

4 GENERAL INSTRUCTIONS AND RULES

In computer science, participation in classroom teaching and carrying out practical work play a much larger role than just studying theory. Most courses comprise lectures and various kinds of exercises, as well as project work. Participation in the lectures will steer students towards essential reading material. The lab work teaches students to apply what they have learned, either individually or in teams.

The teaching methods have evolved towards a more student-centred approach, and the ways different courses have been implemented may vary. Merely following lectures will not lead to good results in learning; the independent work of students is crucial. A 4-credit course, for example, requires about 100 hours of work. The basic rule for planning your studies is that you should reserve about 2 hours of individual work for every hour of teaching (lectures and exercises) during any normal course. The number of lecture and other contact hours varies for each course (and credit). If there are remarkably few teaching hours in relation to the number of credits a course yields, the amount of individual work will be even larger than described above. You should not pack your schedule with as many courses as you can, even if the lectures seem to fit in your schedule. You need to reserve time for all the assignments and reading that belong to a course.

Many courses put special emphasis on teamwork and students learning together. Exercise groups are divided into smaller study circles, where students solve the exercises in accordance with a given schedule. The study circles meet regularly to discuss the principles of solving the exercises and to present solutions. Other forms of teaching are also widely employed, and some courses are heavily based on online material that you are supposed to use independently.

It is important to complete the modules in the correct order so that the prerequisites for each course are fulfilled.

Lecture courses

A lecture course usually yields 4–8 credits. Short courses last for one period, longer courses carry on over the period boundary and then usually last two periods. Each period contains six weeks of teaching followed by a course exam week.

There are usually two ways to complete a course: a lecture course and a separate exam. Both require advance registration in accordance with the deadlines and instructions in the section ‘Teaching – Registration’ and on the web. When registering for a lecture course, students are usually required to select an exercise group; this means that registration for a lecture course is made through an exercise group.

A lecture course usually comprises lectures and one or two course exams. Courses may also include exercises, projects and study circles, which may be compulsory parts of the course and will yield points that affect the final grade. How to complete the course and deadlines for course work will be announced when the course starts, at the latest. Deadlines must be followed. For most lecture courses, you also have the option to take a separate or resit exam at a later date. If the course is heavily based on exercises, projects, etc that are carried out during the course, there may not be the option of a separate or even a resit exam for that course.

Separate exams are exams that are independent of lecture courses but based on the material in the course description. Usually, to take a separate exam, you do not have to participate in the corresponding lecture course. To take a separate exam, you do not have to participate in the corresponding lecture course, but for courses that emphasize other components than the lectures (exercises, project work), there is usually no separate exam; these courses may offer a resit exam in addition to the same course components required during the course itself as for those taking the course exam. Please see the web page Studies for the exam schedule.

How to complete the courses and what their learning goals are is detailed in the course descriptions on the course pages. The course pages are available via the Studies web page.

Courses that are marked ‘In English’ in the teaching programme are lectured in English. Some other courses may be given in English, if there are many international students among the participants. The advanced courses in the Algorithms and Machine Learning and Networking and Services sub-programmes are mainly given in English. You can always take course exams in Finnish or Swedish as long as you agree on it beforehand with the teacher.

For the MSc degree, the maturity test that is part of the MSc thesis must be written in the language of the MSc thesis. The assignments for the course Scientific writing, i.e. the Bachelor's thesis and the maturity test, should be written in the language in which students completed their school matriculation exam.

Laboratory work

The requirements for the Bachelor’s degree include three independent projects called lab work (to distinguish them from the smaller assignments included in lecture course components). The lab work goes deeper into the theory taught during lectures and demonstrates it by implementing concrete programming and designing tasks. This work is carried out in individual lab courses. In order to participate in a lab course, students have to have completed the courses on which they are based before starting the lab course. We recommend that

students take the lab courses immediately after completing the required lecture courses.

There are three lab courses: Ohjelmoinnin harjoitustyö (the programming project, prerequisites are Ohjelmistojen mallintaminen (software modelling) and Ohjelmoinnin jatkokurssi (advanced programming)), Tietokantasovellus (database application, prerequisites are Ohjelmoinnin perusteet (introduction to programming), Ohjelmistojen mallintaminen (modelling software) and Tietokantojen perusteet (introduction to databases)), and Tietorakenteiden harjoitustyö (data structures project, prerequisites are Ohjelmoinnin harjoitustyö (programming project) and the course Tietorakenteet (data structures)).

Each lab course lasts around 6 weeks and new groups are organised in each period. There will be a joint initial lecture for all the teams of each period in the programming and database application projects. At the same time, this is when the teams start working together. The data structures project starts without an initial lecture; the teams meet separately. The project work must be completed during the course, which means that at least 15 hours per week should be scheduled for the lab work. If the work is not finished on time, the project will be considered interrupted. Students who have interrupted their lab work can only retake the course by way of the interrupters' queue.

Registration for the lab courses is binding. However, if it is more than 48 hours until the start of the course, registrations may be cancelled. It is compulsory to attend the initial lecture (for the Data structures project, the team's initial meeting). If students who have registered for the course are not present at the first lecture (initial meeting) and have not contacted the person in charge of the project (for the data structures project, the supervisor of the team), they will lose their place on the team. Later they may register only by way of the list of interrupters. Any free places on each course are filled from this waiting list during the initial meeting. When the places are filled, new students take precedence over students who have interrupted the course.

Each lab course has its own rules and regulations, which can be seen on the course web page.

Bachelor's thesis (as part of the Scientific writing course)

In the course Scientific Writing, students focus on information retrieval and on using scientific source material, as well as written and oral presentations of scientific renderings. The course assignments lead up to the final paper, the thesis (6 cr) completing the Bachelor's degree. During this course, students will also complete their language studies when it comes to Home language (3 cr) as well as the ICT course Seeking research information (1 cr) and the maturity test (0 cr). The skills and methods taught at this course will also be useful for writing your Master's thesis (Pro gradu); at that stage, there will not be any teaching in

writing skills.

The courses in scientific writing are given each term, and are only intended for students majoring in computer science. Students may register for this course when they have completed the compulsory basic and intermediate module (lecture courses and laboratory work), except Software engineering and the Software engineering project. It is not recommended to take this course in the same term as the Software engineering project. Pre-registration is required for this course during the preceding term (for the autumn in May, and for the spring in November).

The topics of the assignments correspond with the research areas of the sub-programmes at the department, and researchers from the sub-programmes will supervise the work. When registering, students may select the assignment topic they are interested in. Groups are organised as need arises, but all topic requests may not be fulfilled. The topic of the BSc thesis is not formally tied to the choice of sub-programme at the Master's level.

The maturity test that is part of the BSc degree is a part of the process of writing the Bachelor's thesis, and will be taken in connection with the course Scientific writing. For the MSc degree, the maturity test that is part of the MSc thesis must be written in the language of the MSc thesis. The assignments for the course Scientific writing, i.e. the Bachelor's thesis and the maturity test, should be written in the language in which students completed their school matriculation exam (in Finland).

Seminars

The Master's degree includes two seminars (6 credits) and the advanced module taken as minor subject includes one seminar. Postgraduates take seminars in accordance with their postgraduate study plan. A seminar is usually based on presentations and discussions. Each student is required to write at least one literary survey, give a presentation, and actively participate in discussions and other work. Apart from some special exceptions, the whole seminar is conducted in the language set for the seminar. Seminars are evaluated on the presentation, on a written assignments, and general participation. Seminars may vary in how they progress, but they usually meet once a week for a whole semester (two periods). Seminars that follow a different schedule contain the same amount of work.

Before starting a seminar, you must have completed your BSc degree. The number of participants in any seminar is limited to around 11-13. If more students want to attend, the teacher decides whom to accept. NB: Students register for the autumn seminars during the previous spring and the spring seminars during the previous autumn.

Master's thesis (Pro gradu)

The Pro gradu is a final thesis for the MSc degree, and yields 40 credits. Students must have completed their BSc degree and the most part of their Master's programme before they start to work on their thesis.

It usually takes at least one term of concentrated work to write a Master's thesis. Because of the nature of this work, the amount of work varies and it is hard to predict.

The Master's thesis should mainly be written on the subject of the student's sub-programme and the compulsory advanced courses. Students must always discuss the topic of their thesis with the professor in charge of their sub-programme. If the topic of a thesis crosses the boundaries between the sub-programmes, the student may have to take some courses from the other sub-programmes even before starting work on the thesis. Students must settle in which language they will write thesis with the supervisor and the professor in charge of the sub-programme.

The work is divided into two stages with regard to guidance and supervision: familiarisation with the topic and independent research. During the familiarisation stage, the student will write a thesis plan. This stage is considered over when the thesis plan has been approved. For more information on the thesis plan and the contents of a Master's thesis, as well as the thesis work, please see http://www.cs.helsinki.fi/en/studies/msc/master-science. One good way of finding a thesis topic is to study the research groups at the department, presented on the page http://www.cs.helsinki.fi/en/research and on the pages of the sub-programmes.

In addition, questions about starting your thesis are discussed at special events held once each term. These events would be good to attend at a suitable stage of your programme. The seminars often support thesis work; in some cases, seminars are specifically aimed at students embarking on their thesis work, and they will discuss the topic of their thesis in their seminar presentation. The maturity test for the MSc degree should be taken as a part of the thesis process, in the language of the thesis.

Personal study plans (HOPS) and teacher tuition

The goals of teacher tuition is to support scheduled studying as well as promote the interaction between students and the department. New majoring undergraduates should sign up for the course (LuK-HOPS) containing their personal study plan and teacher tuition at the beginning of their first autumn term. This course will continue throughout their Bachelor's programme. Those who enter the university in spring should contact the person in charge of the HOPS course at the beginning of the term.

Each undergraduate makes their own personal study plan, and the teacher tutor monitors the realisation of it. This means that making and following up on their personal study plan is part of the programme for each majoring student. Students in the Master's programmes take a corresponding course (FM-HOPS) during the whole of their programme, with a special tutor for each sub-programme supervising the planning of the Master's programme.

Registering course modules, grades

Single courses are registered without separate application, but modules (basic, intermediate, advanced, other major-subject studies, other studies, postgraduate courses) are only registered on application from the student. Please note that you cannot include major-subject modules (approbatur, cum laude approbatur) carried out according to the degree requirements before 1 August 2005 cannot be included into your BSc degree directly, but they have to be transformed into basic and intermediate modules in accordance with the new syllabus.

To register a module, students must deliver a transcript of their studies and a form that lists the course to be included in the module to the person who will register the module. On the Studies web page, you will find a list of persons who can register the modules, as well as forms and more information.

Minor-subject modules (except the module in method sciences and the 25-credit minor-subject module consisting of separate courses taken elsewhere) are registered at the minor-subject departments according to their own practices. Minor-subject modules are usually accepted into degrees, even if they have been registered under an older degree system (as long as the contents and extent are sufficient for the new system).

In addition to the major and minor modules for a MSc or BSc degree, students need to complete other compulsory courses set in the syllabus in order to gain their diploma. For the BSc degree, students must assemble other major- and minor-subject courses into one module, 'Other courses for the Bachelor's degree,' registering the courses the student has selected into the module. Major and minor modules must be finished before the other-course module is registered.

You can usually have the other studies for the MSc degree (both 'Other major-subject studies' and Other studies' separately) registered at the same time as you advanced module is registered. In this case, too, any minor-subject modules must be registered by that time. The faculty gives out diplomas; you will find a guide on how to apply for a diploma on the faculty's web pages.

As a rule, you can only include courses or modules that are seven years old or less. The registrator may, however, accept older achievements on special consideration.

The grades (1, 2, 3, 4, or 5) for modules are calculated as an average of the course grades included in the module, weighted by the number of credits. However, the weight of the MSc or minor-subject thesis in the calculation of the grade for the advanced module is 15 credits. The average grade will be rounded to the nearest integer; e.g. an average of 1.5 will yield the grade 2/5, lower grades 1/5, etc.

The grades for the MSc thesis and the minor-subject thesis correspond with the numerical grades as follows: l (5), ecl (5), mcl (4), cl (3), nsla (3), lub (2), a (2).

Flexible study rights (JOO)

According to the JOO (joustava opinto-oikeus, flexible study rights) contract between all the universities in Finland, students can seek study rights for courses that their own university does not offer. Based on the JOO contract, students can take courses or larger minor-subject modules that they can include in their degree.

The JOO programme works best if the courses support your sub-programme and specialisation at the Master's level. It is often best to select your sub-programme in the final stages of your BSc programme.

You can apply for JOO-based study rights from the target university according to their practices. For most universities, you can apply with the electronic Joopas application system. The recommendation needed for JOO applications can be had from the Head of Studies. When applying for a recommendation, you should present your study plan, and you must hand in your application for the recommendation before the deadline of the target university. For more details on the JOO agreement, please see the Studies page.

Recognition of credits gained elsewhere

You may be excused from some courses on the basis of previous credits (e.g. gained at another university or as exchange student). In addition, optional courses and minor-subject modules may be recognized for credits.

There are more detailed instructions on how to apply for previous credits to be recognized on the Studies web page. The Head of Studies decides which previous credits can be approved.

Work experience in the IT field as part of your degree

Both the BSc and MSc degrees include the requirement for compulsory traineeships or work-orienting courses. You can gain these credits by describing your work experience in the IT field in an application to the Head of Studies. You can also take the course Software engineering project instead of work experience. For more information on the requirements and application, please

see the Studies web page.

For the BSc degree, you will complete the necessary orientation to working life in its minimum during the Software engineering project, and then you will not need other credits (from work experience). Correspondingly, besides through work experience, you can complete your Master's-level working-life credits with the course Tietotekniikka-ala ammattina (the IT field as a profession) or another course that you can agree on separately.

International student exchange and traineeships

Exchange or traineeships are offered on the basis of various contracts on different levels according to department, university, and country. The main exchange programme is the Erasmus contract between some EU country universities. The university also has several other exchange programmes, including some countries outside Europe. The basic premiss for entering an exchange or trainee programme is for students to be proactive and plan ahead. The periods for exchange abroad vary between a few months to one academic year. The application deadlines vary according to university and exchange programme, and usually occur some 6-15 months before the start of the exchange period. Anyone considering an exchange the following academic year should start finding out about it from the beginning of the previous autumn, at the latest.

The goal is to recognise all credits gained abroad into your degree in full. You can ensure this with a study plan that is approved before you go. In practice, credits are recognised afterwards in the same way as other credits gained at another institution. You may gain credits from international work experience in the same way as any other work experience in the IT field.

The agreements and study plans for international exchange and traineeships are approved by the liaison for international studies or the Head of Studies. For more details on international exchange programmes, please see 'Studies elsewhere' on the Studies web page, and Alma under 'Students' -> 'Support for studies.'

Computer science as a minor subject

1. Admissions

All university students have the right to take the basic module (25 cr) and intermediate module (up to 30 cr) in computer science, or the computer science courses included in the minor subject module of method sciences (up to 55 cr). For more extended modules in computer science, you have to apply for admission, see 'Computer science as a minor subject' on the Studies web page. The Head of Studies approves the applications.

You can apply for admission to the intermediate module of computer science once you have completed the basic module in both computer science and your major subject. You can apply for admission to the advanced module once you have completed both the basic and intermediate module of both computer science and your major subject. In order to gain admission based on your application, you will need grades of at least 3/5 in computer science courses. Unless the course instructions say otherwise, you will need to have gained at least admission to the intermediate module in order to attend advanced courses.

Students who have gained admission to programmes in physical sciences, geology, chemistry, or mathematics can transfer to the computer science programme by a transfer application to the Faculty of Science. For more details on changing your programme, please see the faculty's website or the department's and the faculty's student counsellors.

2. Courses

The first courses for the basic module are given each term and the exercises during each period.

Minor-subject students also have to take into consideration the prerequisites for courses. They are presented in the teaching programme and the online course pages.

5 PLANNING YOUR SCHEDULE

The Bachelor's degree (BSc) and the Master's degree (MSc) are two separate degrees, i.e. the courses in the BSc syllabus are not generally part of the MSc degree, as they were in previous degree systems. You can include extra courses in your BSc degree, but they do not cut back on the requirements for the MSc degree.

In addition to your major subject, the BSc degree includes a compulsory minor-subject module in mathematics or method sciences, and in another minor subject unless you take the extended module in mathematics (method sciences), more details below. For the MSc degrees, only the sub-programme Algorithms and machine learning and the Master's programmes have separate requirements when it comes to minor subjects. For the other sub-programmes, besides the compulsory courses, you can take the required amount of courses, which do not have to form a module.

The optional courses can consist of computer science courses or courses in other subjects. The extra computer science courses can be registered for an extended basic or intermediate module, or they can be registered as Other studies. If you do not take enough courses in another subject/other subjects to form modules, they will be registered as 'Other studies'.

Bachelor's degree (BSc) studies

1. Major subject courses

The major subject syllabus includes the basic module (25 cr) and intermediate module (63 cr). The major-subject requirements for basic and intermediate courses are the same for all undergraduates; the optional and elective courses in the intermediate module bring some opportunity for variation. The set of courses covers the core areas of computer science and includes three projects (the programming project, the data structures project, the database application) in addition to lecture courses, as well as an extensive software engineering project. In addition, the BSc thesis and maturity test are included in the intermediate module, and they are completed during the course Scientific writing. The compulsory basic and intermediate courses should mainly be completed in the order described under 'BSc course timing.' (model schedule). You may not follow the schedule exactly, but you do have to follow the prerequisites that are stated. The course descriptions will give more detail on prerequisites, including elective intermediate and advanced courses.

When planning your optional and elective courses, please take into account that two of the sub-programmes at the MSc level require some intermediate courses. If you have taken those courses at the BSc level, you can choose any elective courses in their stead to replace the ctredits. It is a good idea anyway to consider what you might specialise in at the MSc level when plannign your elective (extra) courses for the intermediate module in your BSc degree.

2. Minor subject studies

Minor-subject studies consist of modules, not individual courses. The first minor subject should be a module in mathematics or method sciences, the basic module (25 cr) at a minimum. You can select your other minor subject and possible extra minors freely. If you take modules of at least 50 credits in your first minor subject (the extended basic module, two basic modules of at least 25 cr, or both basic and intermediate modules, totalling at least 60 cr), you are not required to take another minor subject. The modules in method sciences consist of courses in mathematics and statistics; there must be at least 10 credits of each subject in your module. Acceptable courses are listed in the presentation of method sciences. The course Johdatus diskreettiin matematiikkaan (introduction to discrete mathematics, 5 cr) is compulsory in all combinations.

You should start your mathematics or method sciences courses immediately when you enter university, and even if you are taking the extended modules, complete them during your first two years. The first courses in mathematics, especially the introduction to discrete mathematics, must be taken during the first autumn, or your progress will be slowed down considerably. To attend the data structure course of the first spring, you must have completed the

introduction to discrete mathematics (or taken a test to ascertain your pre-knowledge at the very beginning of the spring term). You will also need math skills at the BSc and MSc level. In addition, you will need basic skills in mathematics to be able to follow the scientific literature in computer science for, e.g., your thesis work.

When selecting your minor subjects, you should at the BSc level already consider what you want to specialise in at the MSc level. At the MSc level, modules in mathematics and method sciences are required in the sub-programme on algorithms and machine learning (totally at least 60 cr, including what was completed for the BSc degree). Students aiming for this sub-programme may do well to take an extended minor module in mathematics or method sciences already at the BSc level.

In any case, you should try to make your choice of minor subjects and elective courses go with your major subject to form a sensibly combined degree. It is very much recommended to take a minor module in mathematics or method sciences that is larger than the minimum already at the BSc level, as it will benefit you at the advanced level in computer science, whichever MSc sub-programme you select. Mathematically exact thinking and deduction are important skills when solving problems systematically, including practical problems. In this respect, general courses in mathematics, such as courses in analysis and linear algebra, are most important, as they give you a basis to build other maths courses on.

What courses you choose partially depends on what you want to specialise in for your MSc degree. Logic offers formalisms for specification of programming languages and other systems, and is a vital basis for research into databases and artificial intelligence. You will need probability calculus for analysing system performance, e.g. in data communications and distributed systems. Probability calculus is also a basic theory in intelligent and learning systems as well as designing and analysing algorithms.

Statistics is also considered a suitable minor subject (by itself or as part of the method sciences module); please see the descriptions of sub-programmes.

The web pages of the sub-programmes contain recommendations for minor subjects that are especially suitable to support the sub-programme. You can take minor subjects in any other faculty, or even at another university. However, please take into consideration that you have to apply separately or take an entrance exam to gain admission to many programmes at the University of Helsinki. You will need to find out about them yourself; the application deadline or exam often occurs only once a year.

Examples of minor subjects that you can take at the University of Helsinki:

- *in the Faculty of Science* (in addition to mathematics and method sciences) physics, theoretical physics, greography;

- *in the Faculty of Biological and Environmental Sciences* biology (many combined minor subject modules), genetic bioinformatics, genetics, general microbiology, biochemistry;

- *in the Faculty of Social Sciences* (in addition to statistics) minor-subject module in management, national economics, social psychology, practical philosophy, communication;

- *in the Faculty of Arts* theoretical philosophy, general linguistics, language technology (see description of the Language technology network):

- *in the Faculty of Behavioural Sciences* cognitive science, education, adult education, psychology.

You can study at other universities, especially via the flexible study rights system (JOO). Some of the most popular minor subjects include industrial engineering and economics at the Aalto University.

In special circumstances, the department may recognise and combine separate credits gained at another university as a 25-credit minor subject module if their contents form a logical whole. Any credits that that do not fulfil or exceed this 25-credit limit and do not form a module in the institution where they were gained can be placed in the category optional courses (other studies).

3. Other studies

The 'other studies' module must include several compulsory courses as well as completely optional courses that are not included in the major or minor modules.

Language studies include three parts. Communication in home language (3 cr) is included in the course Scientific writing. The university's language centre offers courses in the second domestic language (3 cr) and a foreign language (4 cr). There are descriptions of the structure and arrangements of the courses on the web pages of the faculty and especially the language centre. It is best to complete your language courses as soon as possible at the start of your studies.

The studies in information and communication technology include three courses. The ICT driving license (3 cr) and the course Introduction to the use of computers (1 cr) should be taken immediately at the start of your first year. Their goal is to teach you the use of various tool programs, and especially to teach you the skills to work efficiently in the department's own hardware and software environment.

The course Seeking research information (1 cr) will be included later in the course Scientific writing, i.e. as part of your BSc thesis.

You personal study plan (LuK-HOPS) and participation in teacher tuition (2 cr) will start from the beginning of your first year and last throughout your BSc programme. The credits will be given once you have finished your BSc thesis and all other credits for the degree.

The traineeship or work orientation (1-3 cr) will be completed during the software engineering project (to the extent of 1 cr). In addition, you can apply for 2 more credits on the basis of professional work experience in the IT field; please see instructions on the Studies web page.

The optional courses can consist of computer science courses or courses in other subjects. The extra computer science courses can be registered for an extended basic or intermediate module, or they can be registered as Other studies. If you do not take enough courses in another subject/other subjects to form modules, they will be registered as 'Other studies.'

Master's degree (Msc) studies

The Master's degree is heavily based on major-subject courses (80 cr). A small amount of other compulsory courses are included, as well as some requirements for minor subjects in one of the sub-programmes. The minimum extent of the degree, 120 credits, can include up to 37 cr of wholly optional courses (depending on the sub-programme and, partially, on the contents of your BSc degree).

1. Major subject studies

Besides the advanced courses, the major subject includes one or two intermediate courses in two sub-programmes. If a required course has been taken for the BSc degree, it can be replaced with any elective course (in computer science or another subject).

Depending on the sub-programme, the advanced module includes 1-2 compulsory courses, 1-2 elective courses from a set of specific courses, two seminars (totalling 6 cr), other advanced courses in accordance with the syllabus and the instructions on the web page of the sub-programme, as well as the Master's thesis (40 cr) and the maturity test associated with it (0 cr).

Most of the teaching in the sub-programmes Algorithms and Machine learning and Networks and Services is given in English.

2. Minor subject studies

In the sub-programme Algorithms and machine learning, modules in mathematics and method sciences are required (at least 60 cr). These required minor subjects can be taken partially or wholly as part of the BSc degree, and then this part of the MSc degree can be filled with elective courses.

You can include extra minor subjects into the MSc degree. Suitable minor subjects are listed under the BSc degree and on the web pages of the sub-programmes.

3. Other studies

The Other studies module must include two compulsory courses as well as completely optional courses that are not included in the major or minor modules.

You must take the personal study plan (FM-HOPS) (1 cr), tutored by your given teacher and lasting from the start of your Master's programme and throughout it. The study plan will detail whether the student will need to take courses in the English language (0-4 cr).

The course Orientation to MSc Studies (2 cr) for students who are only taking the MSc degree at the department. This course introduces the tool environment at the department and how to successfully complete a higher university degree with an emphasis on science.

The advanced traineeship or working life orientation can be completed with an applicable course or by working as an advanced professional in the IT field. You can apply for the credits for work experience by following the more detailed instructions on the Studies web page.

The completely optional courses can consist of extra computer science courses, or courses and modules in other subjects. If you do not take enough courses in another subject/other subjects to form modules, they will be registered as 'Other studies'. Extra advanced computer science courses can be added to the advanced module for an extended module, or they can be included in the module 'Other major-subject courses,' where intermediate computer science courses are always included.

Sub-programmes

There are three sub-programmes for the Master's degree in computer science:

- Algorithms and Machine Learning
- Networking and Services
- Ohjelmistojärjestelmien erikoistumislinja (software systems)

Information on the old sub-programmes are available in older study guides and the sub-programmes' web pages, which you can find via the Studies page.

Algorithms and Machine Learning

Future information systems will increasingly contain intelligent parts, whose implementation is often based on machine learning. Learning complex models requires computationally demanding methods. In addition, the constantly growing amounts of data set their own challenge on the efficiency of algorithms. The primary problem area of the sub-programme is the discovery of efficient algorithms for intelligent systems, and more extensive applications for these algorithms on e.g. biological data. This sub-programme also takes a more general look at the theories and application of efficient algorithms and artificial intelligence.

Graduates from this sub-programme are typically employed as technical specialists or researchers. The general methodical skills learned in the sub-programme will enable you to work in both the corporate and the academic world, including projects applying information processing.

The teaching in this sub-programme is mainly offered in English. You should take the compulsory courses of this sub-programme, 'Design and analysis of algorithms' and 'Introduction to machine learning,' as early as possible. The requirements for minor subjects include 60 cr of mathematics or method science modules; it is a good idea to complete a large part of them at the BSc stage. Other recommended minor subjects include statistics, theoretical physics, language technology, cognitive science, and psychology.

The research in this sub-programme focuses on algorithmic data analysis within the auspices of the national centre of excellence Algodan (http://www.cs.helsinki.fi/research/algodan/) and the Complex Systems Computation Group (http://cosco.hiit.fi/).

The goals, details on degree requirements, recommendations, and research areas of this sub-programme are presented in more detail on the Studies web page.

The professor in charge of this sub-programme is Professor Jyrki Kivinen.

Networking and Services

This sub-programme trains specialists and strategical innovators for the planning and implementation of global application platforms. This group's specialities include research into networked systems and their premisses: middleware (including service and application platforms, management of middleware, trust, and safety), mobility (independence of technology and location, wireless

communications), information networks, service networks, context-awareness and interactive systems. This area combines the department's traditional research into wireless and mobile computing with new emerging research topics. The focus of the teaching and research is moving from protocols towards problems on the application level and their solutions.

The goals of the compulsory and optional courses at the advanced level of this sub-programme are to promote the basic conceptual skills in the core areas. For minor subjects, method sciences and your own application area are recommended in addition to mathematics.

The teaching in this sub-programme is mainly offered in English. The goals, details on degree requirements, recommendations, and research areas of this sub-programme are presented in more detail on the Studies web page.

The professor in charge of this sub-programme is Professor Sasu Tarkoma.

Ohjelmistojärjestelmien erikoistumislinja (Software systems)

In this sub-programme, we study the systematic production of large and complex software systems. The development of such system requires technical skills, but other topics that also emerge include team and project work, a disciplined quality control process, documentation, and recycling.

Graduates from this sub-programme typically find employment as technical software or information-management specialists and managers of development projects in software businesses. This means that practical projects play a central role in this sub-programme. At the advanced level of this sub-programme, students may specialise in software engineering, service-orientated software production, or database systems.

Since developers of software systems need a varied skill set, the sub-programme recommends taking another minor subject module besides the required module in mathematics or methods sciences, either in another faculty of the university, or in another university through the JOO agreement. Examples of suitable minor subjects are management, cognitive science, statistics, language technology, industrial engineering, business administration, and various arts.

The goals, details on degree requirements, recommendations, and research areas of this sub-programme are presented in more detail on the Studies web page.

The professor in charge of this sub-programme is Professor Jukka Paakki (autumn term 2010 Juha Taina, PhD).

Interdependencies between courses (pre-requirements)

There are two kinds of dependencies between courses: recommendations and requirements. The recommendations set the required pre-knowledge for the course, and following them is up to each student. At registration and the beginning of the course, it is checked whether students fulfil the requirements. During the academic years 2010-2012, especially the following course prerequisites must be fulfilled (prerequisites in brackets):

- the MSc-stage project courses of the sub-programmes (the corresponding lecture courses)
- the MSc-stage seminars (BSc degree)

Model schedule for Msc degree

The extent of the MSc degree (120 cr) corresponds with two years of full-time studying. Students who have been admitted directly to the Master's degree programme may need to complement their courses in addition to the 120 credits, and in two of the sub-programmes, there are one or more compulsory intermediate courses in addition to the advanced courses. You should not embark on your MSc programme until you have completed your BSc degree and (for those admitted directly to the Master's programme on the basis of a previous degree) any complementary courses deemed necessary. You cannot attend advanced courses in your major subject until you have gained at least 120 credits. The BSc degree is a prerequisite for attending seminars and starting your MSc thesis work.

It is best to organise your advanced module so that you complete the compulsory courses of your sub-programme as soon as possible, and primarily before taking optional and elective courses. The intermediate-module course or courses required for two of the sub-programmes should be completed at the start of the Master's programme, unless you have already completed them for your BSc degree. The sub-programmes may have more detailed information about prerequisites on their web pages. You should complete most of the advanced-module lecture courses and one of the seminars during your first year, so that you will have acquired the necessary background for your Master's thesis by the time you start your second year. In addition to the minimum requirements, further courses required to fulfil the degree (extra advanced courses, elective courses) can be scheduled as you think is best.

Your detailed course schedule depends on your sub-programme and, even more, on your orientation inside your sub-programme. The following formulaic model schedule will give you a guideline:

1st autumn term, 30 credits

- FM-HOPS work (start)

- Compulsory or optional advanced course, 16 cr
- Other courses, including language studies agreed on in your FM-HOPS plan and Orientation to MSc Studies, 14 cr

1st spring term, 30 credits

- Compulsory or optional advanced courses, 12 cr
- Seminar, 3 cr
- Other courses, 15 cr
- This is the term recommended for at least 3 months of international student exchange programme

2nd autumn term, c. 30 cr

- Optional advanced courses, 6 cr
- Seminar,3 cr
- Occupational studies, 2 cr
- Master's thesis (Pro gradu) work (start)
- Other courses, 8 cr

2nd spring term, c. 30 cr

- Master's thesis (Pro gradu), 40 cr
- FM-HOPS, 1 cr (final)

In this presentation, 'other courses' means all courses that you need in addition to your compulsory advanced courses (including the compulsory intermediate course if applicable). If you take other, complementary courses, they will change and extend your schedule.

Transferring from the old degree requirements to the new ones

The degree must be taken according to the requirements at the time of entering the programme, or newer requirements. The degree requirements that were in force before 1 August 2005 are no longer valid, so everyone must transfer at least to the 2005 requirements. The requirements of years 2005-2008 will be valid until 31 July 2011 at the longest. No corresponding deadline has been set for the 2008-2010 requirements.

The teaching mainly follows the latest requirements. Courses following the older requirements will not necessarily be taught at all any more. However, we will try to organise opportunities for gaining the credits for compulsory courses so that students will not be unduly hindered from finishing their courses. Using new courses to replace old ones (rules of recognition) is presented on the web page http://www.cs.helsinki.fi/tutkinnonuudistus/ (in Finnish).

You can include courses that have been completed under different requirements into your degree. However, the credits must fulfil the requirements of some

requirements, either directly or according to course replacement rules: major subject, minor subjects, and other parts following one set of requirements.

Old minor-subject modules (such as approbatur modules) can be accepted into a new degree as long as the contents and extent correspond with the new requirements. A module recognized in the old system that is 15 old credits or less (a half module or equivalent) can be accepted as a minor-subject module in the new degree system only if its extent is at least 25 new credits. Naturally, you can use the module for other (elective) studies in the degree, if its extent is under 25 credits.

6 POSTGRADUATE DEGREES

The aim of postgraduate studies in computer science is to specialise in depth in some field of computer science and attain a skill level where you have the ability to produce new scientific knowledge. The core of postgraduate work is the creation of an independent scientific presentation, i.e. the doctoral thesis. For the doctoral degree, the highest scientific requirements are set on the thesis: the thesis must show scientific maturity and must contain internationally significant new information.

The recommended aim of postgraduate studies is to take the doctoral degree directly. It is unusual to take a licentiate degree; if necessary, the manuscript for a doctoral thesis can be passed as a licentiate thesis. It is generally a good idea to strive for results that can be published internationally immediately after you have reached good enough basic skills. It is customary to publish scientific results even before publishing your thesis, as conference papers and journal articles, and it is also possible to compile your thesis out of this kind of single publications. The other kind of dissertation is the monograph that contains the whole thesis work as one unified study.

Postgraduate courses include courses in your chosen field – either computer science or suitable minor-subject courses – as well as general postgraduate courses (please see degree requirements). The grades for courses that you want to include in your postgraduate degree have to be at least 3/5. The courses you plan to include in your postgraduate degree should be completed as soon as possible, so that you can concentrate on your research. According to the faculty's instructions, pre-examiners for a thesis will not be set until the candidate has completed his or her postgraduate courses. If you are a full-time student, it is possible to complete the doctoral degree in about four years after completing your basic degree.

Each postgraduate is appointed a personal supervisor who is in charge of monitoring the progress of the students and that the scientific work follows a high enough standard. Postgraduate studies start with planning the topic of your thesis in cooperation with this supervisor, as well as the contents of your

research-field and general postgraduate courses, which will be entered as your postgraduate degree plan on the application form for postgraduate study rights at the faculty. As an appendix to the form, add a research plan of at least 4-5 pages, which you will write together with your supervisor. Postgraduates are also appointed two mentors who will follow the student's progress and support their research.

The faculty grants admission to take a postgraduate degree on the basis of the application. At the department, there is a postgraduate committee that handles postgraduate applications. The chair or a member of the committee will sign the application to approve it. The department follows the admission criteria of the faculty when processing these applications, so things that will be taken into consideration are the availability of supervision, success in your basic degree, the research plan and how realistic the postgraduate plan it. The postgraduate plan can be updated when necessary, at least once a year.

Students who are planning a postgraduate degree should contact the research group at the department that carries out research in their area of interest when they finish their Master's thesis, at the latest – possibly even when selecting the topic for their MSc thesis. The group will be able to offer support in the form of scientific expertise, discussions and innovations, as well as international contacts. Belonging to a research group will also make it easier to fund your work, sometimes as early as your MSc thesis work, and easier to find a supervisor who will take charge of your PhD thesis work. The research areas and groups at the department are listed on the research page at http://www.cs.helsinki.fi/en/research/.

A majority of postgraduate students belong to the so-called graduate schools. The graduate schools (http://www.cs.helsinki.fi/en/studies/phd/phd-studies) organise postgraduate courses, and through them you can apply for a fulltime research education position. The department participates in four graduate schools and a large postgraduate-school network (see below). You can also fund your postgraduate education by working in one of the research projects or as an instructor at the department. Another way to carry out your postgraduate degree is to work in R&D at an ICT company or in a research institute, though this kind of arrangement has proved itself to be very labour-intensive.

There are more instructions and guidelines for postgraduates on the faculty's web page http://www.helsinki.fi/ml/tutkimus/ and the department's web page http://www.cs.helsinki.fi/en/studies/phd/phdstudies.

Helsinki Graduate School in Computer Science and Engineering, HeCSE

The Helsinki Graduate School in Computer Science and Engineering is a joint postgraduate school between the Computer Science Department of the University of Helsinki and Aalto University's computer science departments and

research units. The Department of Computer Science administers the school. This graduate school was established in 1995. The research education given at Hecse focuses on core concepts and methods in computer science. More details: http://www.cs.helsinki.fi/hecse/.

Finnish Doctoral Programme in Computational Sciences, FICS

The Finnish Doctoral Programme in Computational Sciences (FICS) is a national postgraduate school coordinated by the Aalto University. The research education of FICS focuses on the computational methods of statistics, computer science, physics, applied mathematics, biology, and other sciences. This graduate school was established in 2010. More details: http://fics.hiit.fi.

Graduate School on Software Systems and Engineering, SoSE

The Graduate School on Software Systems and Engineering (SoSE) is a national postgraduate school that focuses on software engineering. It was established in autumn 2006. This postgraduate school is coordinated at Tampere University of Technology. More details: http://www.cs.tut.fi/~sose/.

Future Internet Graduate School, FIGS

The Future Internet Graduate School (FIGS) is a joint postgraduate school between the University of Helsinki, Aalto University, and Tampere University of Technology, coordinated by Aalto University. This graduate school was established in 2010. More details: http://figs.hiit.fi.

Network of Finnish Graduate Schools in Information Technology (Figsit)

The Network of Finnish Graduate Schools in Information Technology (Figsit) is an informal forum for cooperation between different computer science and engineering graduate schools around the country. In addition to HeCSE, the network includes Comas (Jyväskylä), ECSE (the University of Eastern Finland), Infotech (Oulu), TISE (Tampere) and TuCS (Turku). Postgraduate courses are open to everyone in this network, and information about them is concentrated to the network's website. More details: http://www.cs.helsinki.fi/figsit/.

Helsinki Institute for Information Technology HIIT

Helsinki Institute for Information Technology (HIIT) is a joint research institute between the University of Helsinki and Aalto University, with the goal to strengthen strategic research into computer science significantly, as well as promoting the cooperation between the University of Helsinki and Aalto University. HIIT carries out high-end computer science research in close cooperation with other disciplines and application bodies representing the

industries. HIIT operates both at the Helsinki University Department of Computer Science in Kumpula and the Otaniemi campus of Aalto University. More details: http://www.hiit.fi/.

7 TEACHING

The teaching programme for the whole year (lecture and seminar schedules) are listed on the Studies web page. The page also presents a more detailed teaching programme for each term, including the schedules for exercise sessions.

The teaching programme includes the MBI teaching given at the department; the teaching of this Master's programme is described in details on its web page http://www.cs.helsinki.fi/mbi/. Most of the computer science courses given for the bioinformatics programme can also be included in the computer science module. Computer science students (and the minor-subject students within the framework of their study rights) can usually attend these courses unless attendance has been limited specially.

When registering for courses you must use the detailed teaching programmes for each term. Please check the schedules for course and separate exams on the Studies web page. Often, new courses will be added to the preliminary teaching programme set for the whole year, and you will be informed about changes via the students' mailing list and the Studies web page.

Registration

Registration for courses and separate exams is done via the department's online ILMO system, not the OODI system. Registering for a course means registering for exercise sessions, study circles and other course activities as well as the course exams, if any; there is no separate registration for course exams.

The binding registrations for course exercises start about a week before teaching starts for periods I and III, and 3 weeks before the start of teaching for periods II and IV; please see the Studies page for more details. You must register for lecture courses on the first week of lectures, at the latest. You must sign up for separate exams on the Monday of the week before the exam, at the latest.

Students sign up for the course Scientific writing, for the software engineering project, and for seminars at the end of the previous term, see 'Important dates.'

You should also use the ILMO system to register for the project groups in the lab courses. Students who have dropped out of a project can only register to the list of dropouts for that lab course. You can register for the project groups up until the first lecture (for the Data structures project groups, until the initial meeting). Everyone who has registered must attend the first lecture (initial meeting), or they will lose their place in their group.

Computer access

To use the university's shared systems and network services, you need a user account from the IT Department. For the Computer Science Department's computers, you will typically need the department's separate user account, given by the department. You can only use the department's system temporarily with the university's user account. New students can activate their account online with online banking codes or an electronic ID card. There are instructions on the page http://www.cs.helsinki.fi/en/compfac under User accounts.

Teaching facilities

Most teaching is given in Exactum on the Kumpula campus. Auditoriums A111 and B123 are located on the 1st floor and Auditorium CK112 on the ground floor. The first letter of the room IDs (A, B, C, D) indicates which part of the building they are located in, and the number the floor (K1 = ground floor).

Course descriptions

The descriptions, goals, and prerequisites of courses, and how to complete them, are listed on the online course pages. The significance of the course literature varies in different courses; how compulsory or recommended it is will be explained on the course page. If a course description says 'no separate exam,' it means that you cannot complete the course without attending the course instruction.

8 TEACHERS

Teachers can be contacted during their office hours. The office hours are held at the Department of Computer Science (Exactum, Kumpula campus). The office hours are in force annually 1 Sept-31 May, except during Christmas break. The office hours are listed on the web page http://www.cs.helsinki.fi/en/people and by the office door of each teacher, and possibly on their web pages.