

New Master's degree students at the Department of Computer Science at the University of Helsinki

Introduction

Welcome to begin your Master's degree studies at the Department of Computer Science at the University of Helsinki! This document will give you some information on studying at our department, and especially it describes what kind of skills we assume that you have at the beginning of your studies. This document also contains a couple of preliminary assignments that we want you to complete during the summer before autumn term 2012 begins. Submit your essay assignment in a PDF format at latest on the 1st of August 2012 to cs-msc-programmes@cs.helsinki.fi.

Studying at the Department of Computer Science

The University of Helsinki is a strongly research-oriented university, which shows in our teaching and the skills required from our students. In addition to the basic skills of understanding and remembering, we expect you to be able to apply your new skills and knowledge to different problems as well as to analyze, evaluate, and create new information based on existing material.

You will be in charge of your studies. You are the manager of your own studies. Teachers will share their knowledge and create tasks that help you to practice the things to be learned, but they are not responsible for your learning. You must demonstrate your knowledge and skills in exercises and exams, as well as in the projects you are given during your studies. And you need to be able to reflect on your learning and improve those skills you do not yet master to pass the exams and the essays. We do expect you to be able to apply the knowledge, simply repeating the content will not even allow you to pass the courses. The depth of required knowledge surprises new Master's students every year.

The academic year at the University of Helsinki consists of two terms: an autumn term and a spring term. Some courses are also held during summer, but this mainly applies to courses at the Bachelor's level. Both the regular terms have two teaching periods that are seven weeks long (6 weeks for lectures and exercises and one week for exams). This means that the periods at the University of Helsinki are very intensive, and that our students have only a limited amount of time for learning things and adapting to the learning styles required. Some international Master students have found this very challenging, because our teaching and learning styles can be very different from what they were used to in their earlier education. For example, we expect our students to be in charge of their learning. This means that there are very few obligatory classes/sessions, but the lectures and exercise sessions are, of course, very useful for learning. Still, most of the learning happens outside the classrooms. A student who is not able to self-control his or her learning, might find it difficult to work and proceed with his or her studies properly.

Here is a more detailed list of the skills that we expect our Master's degree students to have:

- Independent problem-solving capabilities

In our courses, you typically get several exercise tasks per each week. To prepare for this, see exercises in almost any university-level course book. As you will be in several courses at the same time, this means that you are expected to solve dozens of such problems in total during each week. In addition to weekly exercises, or instead of them, you may need to write essays or implement small programs, etc.

Please note that you are expected to discuss the problems and your solutions or any difficulties encountered on the way with the teachers. The discussions require initiative on your part. Our teachers are not monitoring your progress, their assumption is that if you encounter a problem, you will be the active party and ask for help.

- Initiative

You are expected to contact teachers and instructors, if you encounter a problem. They are willing to help you, but they do not know the problem, unless you verbally present it to them. Teachers like to discuss matters with students, and most of the former students have said that they should have contacted the teachers earlier with their problems.

- Time management

You are in charge of your studies and learning, and you are the only person, who knows how much workload you can handle during the periods. (To a certain limit, you are allowed to expand your study time and have slightly less courses for each period.) You must create your own study schedule and follow it. There are very few obligatory teaching sessions, and the focus is on the learning objectives and not on participation. This does not mean that you should not be present in class, it only reflects the fact that you are in charge of your studies. Be on time for all meetings, Finns are very punctual on that.

- Communication skills

The teaching in our Master's degree programmes is given fully in English. You are expected to be able to communicate fluently in English with your fellow students and teachers both orally and in writing. This holds for lectures, exercises, scientific writing, as well as seminar presentations and discussions.

- Strong programming skills

You are expected to be able to implement a program of hundreds (or even thousands) of lines. The strongly modular program must be commented and written on a style that makes it easy for others to read and modify. Structures like lists, trees, arrays, etc. with their handling algorithms should be something you know by heart. Networking and services (and CBU ICT) students are also expected to know how to write a network program. That is a program which has two parties, a client and a server, on separate computers and those parties are communicating with each other for a joint task. The programming language is not an issue, these skills are common to all languages, and if you master one or two languages, it is easy to learn new ones.

- Mathematical skills

Our Master's students are assumed to have strong mathematical skills. Knowledge of statistics is also important in studies at our department. This holds especially for students in the programme on Algorithms and Machine Learning.

- Scientific reading and writing

At our department, we expect our students to be able to read scientific articles (published in scientific journals and conference or workshop proceedings), and to write seminar papers, conference papers and a thesis following the writing practices used in science. That is, finding references, using proper citation techniques, following the ethical writing practices, structuring the text properly, etc. If this is totally new for you, you should consider reading a book about scientific writing. In our Bachelor's-level studies, the students use Justin Zobel's book "Writing for Computer Science", Second Edition, Springer-Verlag, 2005 for this purpose. If you are not able to access the book, you can read the Writer's handbook by the University Wisconsin-Madison at <http://writing.wisc.edu/Handbook/index.html>.

Preliminary assignments for summer 2012

There will be four assignments for the summer 2012:

1. Write an essay – submission deadline August 1, 2012. If you miss the deadline you are expected to participate to the course “Academic Writing for Students in English-Medium Master's Degree Programmes 1” during the Period 1. *Guidance available for drafts submitted by June 27* (Feedback July 15 due to summer vacations).
2. Create your study plan – bring it with you when you arrive or send by email before arrival
3. Read scientific articles – read more articles on your own time
4. Practice your programming and computer usage skills. At the department of computer science at some point during your studies you will be using remote Linux computers via a command-line interface.

Make sure that you submit your essay on time to cs-msc-programmes@cs.helsinki.fi preferably in PDF format.

1. Write an essay

Our experience is that scientific reading and writing are skills that most students need to improve. You will have several opportunities for this during your studies, but it is a good idea to start working on these skills immediately. That is to start to learn to become an expert, who is able to find scientific articles on a given topic and who is able to read, understand and use the material in them.

Our master students are expected to have some basic level of scientific writing skills from the beginning. There is a special scientific writing course in the first period. During that course you will write one scientific article (15 pages) based on existing articles. To estimate your starting level and to prepare suitable teacher resources for this course, you need to write and submit a scientific essay following all the scientific writing practices you are able to use already.

Your essay (1-2 pages, 500-800 words) must have title, your name, email address and a list of references. Remember to use proper citations and references list also. Make sure that you write in your own voice and do not directly copy any sentences from the article. This is important, because copying is considered cheating!

If you do not know what an essay is, please see for example page:

<http://www1.aucegypt.edu/academic/writers/>

We will grade the courses using scale 0-5, 0 fail and 5 best grade. When we transfer the scale to essays, it would mean something like this in essay grading:

0. Failed. Not submitted, wrong content, omitted following the instructions, cut-and-paste material, ... There can be several reasons why the essay does not fulfill the minimum acceptance criteria.
1. Weak, barely acceptable, essay that omits several aspects. Poor quality language.

2. Structurally OK essay, but still missing some required aspects.
3. Satisfactory essay that fulfils the (minimum) requirements, that shows some individual thinking and/or deeper knowledge. Proper language.
4. Fine essay that discusses the required aspects and clearly shows individual thinking.
5. Excellent essay that clearly shows that the student masters the content very well. Excellent language quality.

Essay Topic Alternatives:

Here are your alternatives. Select an article from your own specialization area that you are most interested about. Later, you are expected to create a study plan for your studies in that area reflecting the same interest in course selections. You can find the PDF copies of the articles from <http://www.cs.helsinki.fi/u/niklande/papers/summer2012/>. If you are not able to access the article you want to write about, please ask cs-msc-programmes@cs.helsinki.fi of the article and we will send you a PDF copy.

Remember to write your own essay in your own voice. Remember that you are required to write a full essay, not just answers to these or similar questions. It is very important that you use scientific writing style and justify all your claims carefully.

Networking and Services (and CBU-ICT students):

1. Offloading to cloud. Based on article *E. Lagerspetz and S. Tarkoma: Mobile Search and Cloud: The Benefits of offloading. From Proceedings of 1st IEEE PerCom Workshop on Pervasive Communities and Service Clouds, IEEE, 2011, pp. 117-122* write your own essay about your own ideas on this matter. You may consider questions like

- How do you see this matter?
- What is the article's key point? Argue for and against its feasibility.
- Which communication technique would you choose to use in such a situation, if they were all available? Why?
- Would you be interested in using this application? Why / why not?
- What other application areas do you think would be suitable for this method? Why?
- ...

2. Floating content. Based on article *J. Ott, E. Hyytiä, P. Lassila, T. Vaegs and J. Kangasharju: Floating Content: Information Sharing in Urban Areas. 2011 IEEE International Conference on Pervasive Computing and Communications (PerCom), IEEE, 2011, pp. 136-146* write your own essay about your own ideas on this matter. You may consider questions like

- How do you see this matter?
- What is the article's key point? Argue for and against its feasibility.
- What kinds of information do you think would have the longest floating times? Why? Give an example (if possible)

- What kind of application or test scenario would you like to build using this idea? Why?
- How would you attract users for such application or test?
- ...

3. Mobile interfaces for energy awareness. Based on article *A. Spagnolli, N. Corradi, L. Gamberini, E. Hoggan, G. Jacucci, C. Katzeff, L. Broms and L. Jönsson: Eco-Feedback on the Go: Motivating Energy Awareness. IEEE Computer, May 2011, pp. 38-45* write your own essay about your own ideas on this matter. You may consider questions like

- How do you see this matter?
- What is the article's key point? Argue for and against its feasibility.
- What are the key interface technologies used in the prototype? Why?
- Would you be interested in using this application? Why / why not?
- What other application areas you think would be suitable for these technologies? Why?
- ...

Algorithms and Machine Learning:

4. Compression of weighted graphs. Based on article *H. Toivonen, F. Zhou, A. Hartikainen, and A. Hinkka: Compression of weighted graphs. In Proceedings of the 17th ACM SIGKDD international conference on Knowledge discovery and data mining (KDD '11). ACM, 2011, pp. 965-973* write your own essay about your own ideas on this matter. You may consider questions like

- How do you see this matter?
- What is the article's key point? Argue for and against its feasibility.
- What are the key principles on which the compression algorithm is based? Why?
- Would you be interested in using this algorithm? Why / why not?
- What other application areas you think would be suitable for these technologies? Why?
- ...

5. Significant matches of position weight matrices. Based on article *C. Pizzi, P. Rastas, and E. Ukkonen: Finding Significant Matches of Position Weight Matrices in Linear Time. IEEE/ACM Transactions on Computational Biology and Bioinformatics 8, 1 (January 2011), pp. 69-79* write your own essay about your own ideas on this matter. You may consider questions like

- How do you see this matter?
- What is the article's key point? Argue for and against its feasibility.
- What are the key interface technologies used in the prototype? Why?
- Would you be interested in using this application? Why / why not?
- What other application areas you think would be suitable for these technologies? Why?
- ...

6. Semi-supervised learning for WLAN positioning. Based on article *T. Pulkkinen, T. Roos, and P. Myllymäki: Semi-supervised learning for WLAN positioning. In Proceedings of the 21th international conference on Artificial neural networks - Volume Part I (ICANN'11), Timo Honkela, Duch Włodzisław, Mark Girolami, and Samuel Kaski (Eds.), Vol. Part I. Springer-Verlag, Lecture Notes in Computer Science, 2011, Vol. 6791, pp.355-362.* write your own essay about your own ideas on this matter. You may consider questions like

- How do you see this matter?
- What is the article's key point? Argue for and against its feasibility.
- How does the method work? Why?
- Would you be interested in using an application doing this? Why / why not?
- What applications you think would benefit from this method? Why?
- ...

2. Create your own study plan

You need to know what courses you are planning to take during your studies. During the autumn term you need to create a personal study plan for your whole Master's degree. This initial planning task is to plan your studies for autumn term 2012.

Find the course list from the department web pages. Find also your degree requirements there. When you study the degree requirements, please make sure that you access the requirements for 2012 and not the older one. There are some differences in the requirements. Select courses for periods 1 and 2 in such a way that the total number of credits per period is approximately 15-16. Please notice that some courses span over both periods and some courses cover just one period. In addition to the obligatory courses, select the optional courses that are most interesting to you. Do not forget possible studies in minor subjects (like mathematics and statistics) or other studies (Finnish and English language courses, scientific writing, orientation, etc.).

Suggested studies in the First period:

- 97000 Orientation to studies (Active participation to all orientation events like Welcome Fair, tutoring etc., including feedback form)
- 581324 Introduction to the use of computers
- 993734 Academic Writing for Students in English-Medium Master's Degree Programmes 1 (if not submitted the summer essay or coordinator asks to do it)
- 582519 Scientific Writing for MSc in Computer Science
- 582510 Personal Study Plan
- 582417 Distributed systems (for NESE&ICT students, allowed for all)
- 582630 Design and Analysis of Algorithms (for Algorithm students, allowed for all)
- 58127 C-programming (for NESE&ICT students, if not in bachelor degree)
- 582206 Models of Computation (for all, if not in bachelor degree)
- Mathematics studies (for Algorithm students, allowed for all) – you can find courses from the pages of the department of mathematics, please negotiate with study advisor

- One (or two) optional (advanced) courses of your own choice (if the target of 15 credits not filled otherwise) – allowed to do just 10 credits also, if planning to catch up during summer or extend studies to 2,5 years.

Make your own weekly schedule based on the courses you select. Mark in the schedule lectures, exercises. Reserve enough time for individual studying outside the class times. The rule of thumb used at the department is to reserve the same about for solving weekly exercises and reading material than is used for lectures and exercise sessions. Mark for the individual study times in your calendar and mark down also which course you will be studying during that period.

In case of Paja, mark down the times there is guidance available and select the most suitable times for your, starting with the earliest possible times. Here you do not need to reserve that much time for working outside the Paja, but you can do that.

Studies in the later periods:

Part of your personal study plan. See department's study guide for general instructions. No specific model available. Goal 30 credits each term. If the first year is done in proper fashion, plan to start your thesis in Second Fall or be prepared to extend studies to 2,5 -3 years.

582351 Linux Fundamentals in Period 2 is a must for students who are not fluent in script languages. You are expected to have the skills in several lecture and project courses without any guidance during those courses.

Personal Study Plan:

The degree requirements at the University of Helsinki in computer science contain a lot of options. Every graduating master has her unique set of courses and, thus, unique expertise. Masters are experts and there is a good reason to avoid identical experts. This means that you must from the very beginning know, what are your future career goals and make the course selections in such a way that they support your goal. As a short term goal, your course selection must support your master's thesis. If you do not know your interests yet, then you are expected to figure them out during the courses you select in your first year.

So write in your plan first your short and long term goals and then reflect those in your course selection.

3. Read scientific articles

Read at least one, but preferably several published journal or conference papers during the summer. Get yourself accustomed to the writing style used in those articles and the way they justify all their claims.

While reading the articles, think about the questions like these and try to answer them. You can even make notes for you:

- What is the goal / construction of this article?

- What is the research area considered in the article? What are the typical challenges on that area?
- What is the specific research question in this article?
- What are the assumptions or hypotheses of the authors?
- How is the research question studied, validated and justified?
- What are the main results presented in the article?
- What did you learn from the article?
- Did you find any mistakes or flaws in the research done? – This can happen.
- What key words are related to the article? What phrases would you use to find more information on the topic of the article?
- Who are the authors of the article? Where would you start searching for more information on them?

Please notice that all articles do not contain answers to all of these questions. Some may have omitted parts of the process, or selected a different approach. In such a case, you will need to apply the question, or clarify why the article does not cover this issue.

4. Programming and computer usage

If you have been only using computers via graphical user interface, now is a good time to start learning also command line interface and learning the shell commands. You could also start to learn scripting and shell programming. There will be a course about these called Linux Fundamentals available in Period 2, but learning basics during the summer will make your adjustment to our department services a bit easier.

To improve your programming skills: pick up any data structures and algorithms course book and implement one or two larger projects from it.

For a computer science master student, especially networking and services, this kind of questions should be trivial to solve: A randomly selected question from *Kurose&Ross: Computer networking*: "Write a simple TCP program for a server that accepts lines of input from a client and prints the lines on the server's standard input. [To test your program, write a simple client program that connects to it and sends some lines of text to the server. As next step,] on any other machine [than the one running your server program] that contains a Web browser, set the proxy server in the browser to the host that is running your server program; also configure the port number appropriately. Your browser should now send its GET request messages to your server and your server should display the messages on its standard output." If you do not know how to solve this question, you need to learn basics of network programming. You need the skills in the distributed systems course during the Fall and its project in Spring.