Master's Program in Computer Science

Study Guide

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1 Introduction

At every step of our world's move to an information society, key solutions are provided by computer science, also known as informatics: the science of processing information through computer programs. At the hearts of cell phones, airlines and airplanes, financial transactions, company management, publishing of any kind, the internet and world wide web, industrial plant control and all other devices and processes that make today's world run, lie algorithms and data structures devised by computer scientists.
No other discipline has grown so fast in such a short time, and none has better prospects for its graduates in a world that is constantly finding new uses for information technology. Computer science offers a unique combination of scientific and engineering appeal, the growth prospects of a multi-billion dollar industry, and the opportunity for individuals to make a difference.

1.1 ETH Zurich

History
ETH Zurich was founded in 1855 as the "Eidgenössisches Polytechnikum" (Federal Polytechnic Institute). At that time, as the "child" of the new federal government, it was the only national university of Switzerland. Today, ETH Zurich, EPF Lausanne and four research institutions have been linked together to form the national ETH domain.

Mission
The mission of the ETH is to maintain an internationally high standard, both in education and research, in the areas of technical and natural sciences. Its primary objective is the preparation of its students for their professional life as engineers, architects, mathematicians or natural scientists.
Thus, ETH Zurich has the important task of maintaining and developing its top standing in the rankings of internationally renowned universities. They fulfill this forward-looking task in service to the Swiss nation as a nationally based but internationally oriented institution of higher learning.

Infrastructure
The ETH comprises 200 buildings, located predominantly in two main centers in Zurich. The old university quarter is located in downtown Zurich. The ETH main building, the core of this location, was designed by Semper. The second location is situated on the Hönggerberg.
The online library contains over four million books and is Switzerland’s largest technical library.

Education
Education at the ETH Zurich spans four core areas: engineering, natural sciences, architecture and mathematics. In addition, courses in physical education and military sciences are offered. The goal of instruction is to enable students to acquire solid technical knowledge, practical skills, and the ability to take part in interdisciplinary

activities. Relying on an atmosphere of a mutual trust among teachers and students, and a reciprocal awareness of social and ethical concerns, the ETH Zurich encourages in its students both individual creativity and the ability to reflect on and evaluate their own actions, with the aim of achieving a comprehensive outlook and a responsible mode of behaviour. Considering the need for a new approach to knowledge and technology and a better understanding of the nature of man, the ETH Zurich treats the humanities and social sciences as integral parts of its educational profile.

Further education
The ETH Zurich takes into account the fact that learning is increasingly a life-long process. Accordingly, the undergraduate curriculum is kept relatively short and is later supplemented by postgraduate and further education courses. This is to promote a more rapid transfer of knowledge and technology between the university and the world outside.

Research
At the ETH Zurich, teaching and research are closely linked. Equal standing is assigned to knowledge-oriented basic research and to problem-solving applied research. Both areas are dedicated to fulfilling the highest standards, and are long-term oriented. The ETH Zurich is specially committed to the continuous development of that innovative potential within society and industry.

International links
As an institute of higher learning and research, the ETH Zurich cultivates an international standing. It is aware that its scientific contribution has to be confirmed by the international research community. Thus the ETH Zurich strongly supports international co-operation in all fields of research and education. As a long-term strategy, it also devotes special attention to structurally and economically underdeveloped countries.

Co-operation
The ETH Zurich encourages partnerships and interdisciplinary co-operation among members of its community, with other educational and research institutions, with industry, and with the public administration, and it believes in keeping the public informed regarding these activities. The sustainable development of human society depends on our efforts both to create and support a strong and innovative economy.

1.2 Department of Computer Science

Computer Science at ETH is the proud heir to a tradition going back to some of the first computers ever devised (Konrad Zuse's Z4, which he brought to ETH in 1950), pioneering work in numerical computing and logic, as well as the design of programming languages Pascal, Modula-2 and Oberon and associated hardware, user interfaces and operating systems by Niklaus Wirth and his colleagues.
Today the department pursues thriving research in many areas extending from computation theory and information systems to computational science, algorithm analysis, software engineering, programming languages, computer systems, pervasive

computing, security, program proving, web algorithms, large-scale databases, distributed systems, and many other areas at the forefront of computer science and information technology. The Institutes and Groups and Research pages give further insight into these activities.
Courses offered by the department cover the full spectrum of computer science topics and lead to degrees at all levels following the international standard (Bachelor, Master, PhD). In addition to the more than 1000 CS majors, we provide a wide range of computing courses for students of other ETH departments, as well as post-diploma programs.
Computer science is full of intellectual challenges and exciting applications; it is the path to some of the most attractive careers available today. The Education pages provide extensive descriptions of the many available programs and courses.
If you are already a professional, don't forget a visit to the compact courses pages, where you will find a full catalog of seminars offered by the department's professors on topics of current interest to the industry.
The daily life of the department is marked by many events: the CS colloquium (held on Mondays at 16:15 during the semester), brings to Zurich some of the world's most renowned computer scientists; inaugural and farewell lectures of our own professors; regular seminars organized by individual groups; workshops and summer schools; and guest lectures. Most of these events are open to the public and we welcome your participation. Make sure to check our webpage regularly (http://www.inf.ethz.ch).

1.3 Degree programs: BSc, MSc, PhD

The ETH has three different types of programs according to the Bologna contract, each of which leads to a degree. The degrees offered are the Bachelor's, Master's, PhD, and they must be completed in the indicated order.
The Bachelor's program is designed to be completed in three years. A Bachelor of Science ETH in Computer Science is awarded when all 180 necessary credit points are achieved.
All students with an ETH Bachelors degree in Computer Science can then directly get into the ETH Master's program in Computer Science. All other Students have to apply for admission.
The Master's program takes normally one and a half years. The degree awarded is a Master's of Science ETH in Computer Science.
The last program ends with a doctoral degree. PhD students are normally employed as an assistant of their doctoral advisor.

1.4 VIS (Fellow Student Mentor System)

The VIS is the association of computer science students at ETH Zurich. All computer science students are automatically members of the VIS, if they check the box for VSETH in the registration form. The VSETH is the association of all students at ETH Zurich.

The main services of the VIS are:

- Publication of a newspaper ("visionen")
- Collection of old exams for study purposes (questions and answers)
- Organization of the annual contact party, which gives students an opportunity to get in touch with potential employers.
- Party organization (fondues, barbecues, VISKAS, Christmas brunch)
- Event organization (Company visitations, ski-camp in the winter, ...)
- Multimedia Station for students, including DVD writer, scanner and software
- Sale of merchandising material such as cups and shirts

All these tasks are only possible with many active members. The association needs students to take on interesting functions in the executive board and committees on various topics.

The office of the VIS is located in RZ F17.1 (across from the Study administration office). Every visitor is welcome, just drop in. All information about VIS can be found on http://www.vis.ethz.ch.

2 Master's Program in Computer Science

2.1 Qualification Profile

This qualification profile has been drawn up in cooperation with the IDEA League partners.

The skills at the Master level include the skills of a Bachelor to an enhanced extent. The Master's level student is expected to reach a high level of maturity in technical skills and conceptual reasoning, with insight into all layers of abstraction of computer systems (e.g., the layers of specification, of problem- and machine-oriented programming, of computer architecture, of compilation). This is a level where new complex systems can be conceived, modeled, and designed using a range of emerging specialty computing technologies, often involving applications with artificial intelligence, security implications, and distributed network applications.

In his or her field of specialization, a master should not only be able to appreciate the current state of knowledge, but also be prepared to participate in research projects and thus contribute to the advancement of the state of the art.

The engineering competences of a master also often require a level of interdisciplinary awareness of related fields that is second only to specialists of those fields. Thus, at the Master's level we expect considerable awareness of advanced subfields, a capacity for mathematical modeling, and appreciation of the physical, electronic, and cultural environment of application. There is often an interface with technologies emerging from research and development. A Master's level graduate should have the capacity to plan and contribute to such projects, reflect on the state of the art and communicate with professionals from other fields. This level of sophistication requires practical experience of industry, as well as the ability to work both independently and with others.

In more detail, these requirements include the following the skills of a bachelor to an enhanced extent:

(a) Conceptual Knowledge

- Knowledge and understanding of major paradigms of programming (declarative, imperative, and object-oriented)
- basic subjects like program design
- computer systems
- algorithms and computability
- networks and communications
- data bases
- computer graphics
- scientific computing underlying mathematical disciplines, including logic and discrete mathematics
- methodology of software engineering, including specification, implementation, verification, testing, maintenance
- near research level in at least one area of computer science

(b) Skills

- Analysis, formalization, and implementation of programming (and system) design problems, performing a critical evaluation of alternatives
- Evaluation of programs by reasoning about correctness and efficiency
- Construction of abstract models of computer and communication systems
- Matching problems to tools and techniques most suitable for solving them
- Design of experiments for testing and performance evaluation
- Understanding and modeling of large systems, their architecture, construction, and maintenance

(c) Capabilities

Efficient communication in written form, orally, and with computer-aided techniques of presentation. Ability to conduct and document a larger scale project either in a team or individually

In particular:

- Application of management and software engineering skills in team work (coordination, project design, evaluation, cost-effectiveness)
- Effective learning in the continuous updating of professional knowledge
- Ability to reflect on the state-of-the-art
- Ability to communicate with professionals of other disciplines (from science and engineering, or other fields)
- Acquaintance with the integration of computer science in its social and historical context

2.2 Specialization Tracks

The Master's program at the Department of Computer Science offers seven specialization tracks. They all lead to the degree "Master of Science in Computer Science" (MSc ETH CS). Students with a Bachelor's degree in Computer Science from ETH can enter the Master's program without additional requirements. Students from other universities have to apply for admission and may be subjected to additional requirements (chapter 3).
After being admitted to a specialization track, students must find a mentor. All professors or associate professors who participate in the desired specialization track may be chosen as a mentor. Each student will establish a personal study plan after consulting his or her mentor. For more information on the mentoring system see section 2.4.

The following sections contain a short description of each specialization track.

2.2.1 Information Security

Information security is one of the cornerstones for the continued expansion and acceptance of the information society. At the same time it is also a fundamental research discipline within computer science, with many basic open problems, both theoretical and applied.

One of the main paradigm shifts of the emerging information society is that information is stored and exchanged in electronic form. This electronic representation differs radically from traditional representations; for instance, electronic data can be copied without cost, it can be erased without leaving traces, and it can be communicated without effort over large distances. The downside of these features is that protecting information, which is of crucial importance for the information society, has become increasingly difficult.

Problems addressed:

- Finding solutions to pressing security problems
- Laying the foundations for developing a secure information infrastructure for the future.

This Master's specialization track brings together offerings from both the Department of Computer Science and the Department of Information Technology and Electrical Engineering (ITET).

2.2.2 Information Systems

Information systems are one of the core disciplines of computer science. They are important in almost all application areas; in particular, for business applications (e.g., banks, consulting, tourism), personal information (e.g., pictures, letters), science (e.g., geographic information systems, protein databases), and e-Government.

The overall goal is to allow access to information to everybody, everywhere, at any time, where access is constrained only by security and access rights. The goal of this specialization track is to study data models, implementation techniques, and management techniques for modern information systems.

In particular, the following topics are covered:

- Data Models: modern design techniques, object-oriented data models, semi-structured data models and XML, Web services and service-oriented architectures, Semantic Web
- Implementation and Optimization Techniques: transaction management, query processing, distributed and parallel information systems, adaptive and provably efficient algorithms (worst and average case)
- Management: modern database applications, Web-based information systems, client/server and peer-to-peer architectures

2.2.3 Distributed Systems

The track on distributed systems provides an in depth perspective on advanced topics that range from pervasive and mobile computing (wireless networks, sensor networks, mobile computing) to large scale distributed information systems (grid, enterprise application integration).

The track emphasizes hands-on work and will allow students to become familiar with the latest developments in:

- Wireless communication
- Networking
- Sensors
- Mobile devices
- Web services
- Service oriented architectures

Students in the track are given access to several well equipped laboratories for extensive experimental work during the Laboratory course, seminars, course projects, and the Master's Thesis.

2.2.4 Visual Computing

The digital processing of visual information has become a core topic in modern CS and IT. Visual Computing builds upon foundations of Computer Science and applied Mathematics and has a wide range of applications.

Methodologically, Visual Computing is rooted in computer graphics, algorithmic geometry, image processing and computer vision as well as machine learning. Strong conceptual and algorithmic links to Computational Science provide Visual Computing with the modeling breadth and the computational expertise to solve large scale visualization and inference problems.

Covered Topics:

- Fundamentals of computer graphics
- Computer vision
- Machine learning and pattern recognition
- Advanced rendering
- 3D modeling and geometry processing
- Scientific visualization
- Image understanding
- Neuroinformatics

2.2.5 Theory of Computing

Theoretical Computer Science deals with the development of fundamental methods and concepts, sometimes of a speculative nature, for the science of processes and information. Examples are computability, complexity, randomization, on-line computation, zero knowledge proofs, and quantum computing.

These issues are dealt with in a formal manner. This typically allows absolute statements (often relative to some hypothesis) of what cannot be done. Often, however, surprising positive results can also show up (e.g. probabilistically checkable proofs). Many of the questions considered are motivated by applications. It is part of the field to carry the insights back to applications via experimental and implementation work.

The program at ETH focuses on:

- combinatorial and geometric algorithms
- randomized algorithms and probabilistic methods
- security and cryptography
- mathematical foundations of these topics

2.2.6 Software Engineering

Software systems, small and large, lie at the heart of many processes throughout society. The task of software engineering is to make sure these systems are delivered on time, meet their budgets, and work right. The software engineering Master's teaches the techniques that distinguish the true software engineering professional; the resulting skills and knowledge are in high demand in today's job market and will remain a particularly attractive qualification as software systems become increasingly pervasive and ever more challenging.

Topics that fall within the software engineering curriculum include:

- Techniques for building large software systems
- Modern software environments, in particular virtual machines
- Component-based development
- Object technology
- Techniques for building software with verifiable properties (proofs, model checking and others)
- Concurrent and distributed systems
- Modern programming languages
- Requirements and specification techniques

Faculty members participating in this Master's track are actively engaged in numerous research projects across different topics in the field, and offer a variety of challenging master's projects in software engineering, complementing the courses offered.

2.2.7 Computational Science

Computation has become one of the driving forces of our times in scientific inquiry and Engineering Design. Computational Science exemplifies the interdisciplinary approach to problem solving, within the unifying concept of computation. Modeling and simulation complement experimental and theoretical methodologies in the natural sciences and in engineering. Students with a solid education in Computational Science will be able to bridge the gap between core computer science knowledge and computing intensive application areas.

The proposed focus area will acquaint students with core knowledge in Computational Science. Optimization methods, simulation of continuous and discrete systems at various time and length scales as well as graphics and adaptive learning systems define the rich conceptual and methodological curriculum of computational science.

The topics included:

- Computational linear algebra
- Computational biology
- Multi-scale modeling and simulation
- Computer graphics and machine learning

2.3 Program Structure and Course Categories

The Master's program in computer science at ETH Zurich requires a total of 90 ECTS credit points (CP), which must be distributed over a set of course categories as follows:

- Focus Courses 26 CP
- Elective Courses 20 CP
- Multidiscipline Courses 8 CP
- Foundation of Computer Science 4 CP
- GESS Course 2 CP

The 6-month Master's Thesis at the end of the program counts for 30 credit points.

2.3.1 Focus Courses

The focus courses provide a profound understanding of the specialization area. For each specialization track a unique set of focus courses is defined. The list of focus courses can be found on the web page of each specialization track.

2.3.2 Elective Courses

Depending on the specialization track, the elective courses are chosen to provide further specialization or allow a broader education in computer science. On the web page of each specialization track a list of recommended elective courses can be found.

2.3.3 Multidisciplinary Courses

The multidisciplinary courses provide insight into other academic disciplines besides computer science. For computer scientists, who have to interact with many different stakeholders, multidisciplinary education is of especially high value.

The information on multidiscipline subjects can also be found on the website of the Master's program website. Students can choose from several standard multidiscipline subjects. Most of them, however, include lectures taught in German. Nevertheless, you also find a few English language multidisciplinary subjects on the website.

Some standard multidiscipline subjects are more demanding than others. It lies within the responsibility of the student to choose a multidiscipline subject for which he or she has the necessary prerequisite knowledge.

It is possible to choose lectures for a multidiscipline subject of one's own liking and get it approved by the student counselor. For multidisciplinary courses only courses that are not offered by the Computer Science department are allowed. Multidiscipline subjects can

also be languages other than: German, French, Italian, English or Spanish. Foreign students may not choose the language and culture of their home country as multidisciplinary course subject.

We advise to discuss the choice of the multidiscipline subject and the corresponding courses with your mentor.

2.3.4 Foundation of Computer Science

The category Foundations of Computer Science comprises the following courses:

- Theory and Algorithms
- Computer Systems
- Computational Science
- Information Systems
- Programming

Students must pass the course on programming and three out of the other four courses.

The courses are self study courses based on material that students should know from their Bachelor program. The main aim of these courses is to ensure that all our Master's students have a profound knowledge in computer science that is not restricted to their area of expertise.

For each course there is a webpage which clearly states the material covered by the exam as well as organizational details.
(http://www.inf.ethz.ch/education/programs/master/master_program/curriculum/categories_structure/foundations/index)

2.3.5 GESS Course

One course in social sciences and humanities is part of every Master's program at ETH. The course list for GESS courses (German: Geistes-, Staats und Sozialwissenschaften) can be found at: www.gess.ethz.ch.

2.3.6 Master's Thesis

The Master's thesis is the result of a 6-month project in the area of specialization. The mentor or a professor who participates in the chosen specialization track supervises the thesis. With the successful completion of the Master's thesis students show their competence as computer scientists.

Before starting a Master's thesis it is important that student and supervisor agree on the task description and the assessment scheme in writing. Both must be written down in detail. This document serves as reference in case of disagreement.

Students may start the thesis project only after they have collected the minimum number of credits for each course category. Students who enter the Master's program under the condition that they fulfill additional requirements must also have acquired the credit points for the additional requirements.

In order to successfully complete the Master's thesis a grade of 4.0 or higher must be obtained (for the swiss grading system see page 24). In case of failure, the Master's thesis may be repeated once, by completing a different project.

2.4 Mentor System

As discussed in section 2.2, each student has to have a mentor who must be chosen before starting the Master's program. All professors participating in the desired specialization track can be asked to serve as mentor. A student has to contact a potential mentor by herself or himself and, upon acceptance, discuss her or his study plan with the mentor. It is up to each student to complete the personal study plan. But the mentor will be happy to give advice. For more information on the personal study plan please see section 3.3.

3 Admission, Enrolment and Registration

All applicants apply online. The admission process varies depending on the University at which the Bachelor Degree was obtained. There are **five cases** for **admission**:

- Students with a Bachelor degree in Computer Science from ETH
- Graduates of Partner Universities
- Graduates of Swiss Universities
- Graduates of Swiss Universities of Applied Sciences
- Graduates of other Universities

For each case **information on admission** and the address of the corresponding website is listed in the following subsection. Information on **enrolment and registration** that applies to all students is at the end of this chapter (page 22). In addition to the enrolment at ETH, students have also to register at the Department of Computer Science as described in the last subsection of this chapter.

3.1 Admission of Students with a Bachelor Degree in Computer Science from ETH

Students with a BSc in computer science from ETH can directly enroll in the Master's program if they have obtained in each course category at least the following number of credit points.

Course Category	**Credit Points obtained**
Base Year	60 CP
Compulsory Courses	61 CP
Core Subjects	12 CP
Compulsory Specialized Courses	4 CP
GESS	3 CP
Total	**140 CP**

3.2 Admission of Graduates from Partner Universities

Graduates in Computer Science of Partner Universities are admitted without additional requirements. Our Partner Universities are:

- ETH Lausanne
- Imperial College London
- Technical University of Delft
- Rheinisch-Westfälische Technische Hochschule Aachen

For detailed information on the admission procedure, see:
http://www.admission.ethz.ch/master/how_to_apply/required_docs/cate

Please fill in the online application form and include the following information:

- your preferred specialization track
- your preferred mentor for this specialization track (optional)

3.3 Admission of Graduates from Swiss Universities

Students with a degree in Computer Science from Swiss Universities are generally admitted to the Master's program in computer science at ETH. If the applicant's Bachelor program does not correspond to the CS Bachelor program at ETH, the candidates may be requested to complete up to 60 additional credit points. These additional requirements consist of courses from the computer science bachelor program at ETH. Such additionally required courses can be completed before or after starting the Master's program. The courses, essential for the specialization track, are advised to be completed before the Master's program.

Core requirements (43 credit points):
These courses are part of the first two years of the ETH bachelors program. All applicants must have completed these or equivalent courses. Information about these courses can be found on the online course catalogue, available at:
http://www.vorlesungsverzeichnis.ethz.ch

Analysis II	3 CP
Linear Algebra	7 CP
Logic	4 CP
Discrete Mathematics	7 CP
Probability and Statistics	5 CP
Introduction to Computational Science	4 CP
Theoretical Computer Science	7 CP
Formal Methods and Functional Programming	6 CP

Specialization requirements (17 credit points):
These are additional requirements that relate to the specialization track chosen by the applicant. They will be defined by the applicant's mentor.

For detailed information on the admission procedure, see:
http://www.admission.ethz.ch/master/how_to_apply/required_docs/catc

Please fill in the online application form and include, in addition to the documents already required by the admission office of ETH, the following:

- letter of purpose (personal motivation statement)
- your preferred specialization track
- your preferred mentor within this specialization track (optional but recommended)

3.4 Admission of Graduates from Swiss Universities of Applied Sciences

Graduates in computer science with a degree from Swiss Universities of Applied Sciences are admitted to the Master's program. Additional requirements of at most 60 credit points can be imposed by ETH. These additional requirements ensure that the competences of the candidate are equivalent to those of a graduate of the ETH bachelor program. These additional requirements consist of courses from the computer science bachelor program at ETH. Such additionally required courses can be completed before or after starting the Master's program.

Core requirements (43 credit points):
These courses are part of the first two years of the ETH bachelors program. All applicants must have completed these or equivalent courses. Information about these courses can be found on the online course catalogue, available at:
http://www.vorlesungsverzeichnis.ethz.ch

Analysis II	3 CP
Linear Algebra	7 CP
Logic	4 CP
Discrete Mathematics	7 CP
Probability and Statistics	5 CP
Introduction to Computational Science	4 CP
Theoretical Computer Science	7 CP
Formal Methods and Functional Programming	6 CP

Specialization requirements (17 credit points):
These are additional requirements that relate to the specialization track chosen by the applicant. They will be defined by the applicant's mentor.

Partial remittance of additional requirements
The Admission Committee may remit up to 20 credit points for candidates who can show that they fulfill part of the additional requirements. Graduates in Computer Science from a Swiss University of Applied Sciences can therefore be asked to complete between 40 and 60 additional credit points requirements.

For detailed information on the admission procedure, see:
http://www.admission.ethz.ch/master/how_to_apply/required_docs/catd

Please fill in the online application form and include, in addition to the documents already required by the admission office of ETH, the following:

- letter of purpose (personal motivation statement)
- your preferred specialization track
- your preferred mentor within this specialization track (optional)

3.5 Admission of Graduates from foreign other Universities

Graduates in Computer Science from non-Swiss Universities can apply for admission to the Master's program in Computer Science at ETH. Applicants may be required to complete up to 60 additional credit points from the Computer Science Bachelor Program at ETH. The additional requirements are limited to 60 credit points. Additional required courses can be completed in parallel to courses of the Master's program.

For detailed admission procedures, please refer to the website of the admission office: http://www.admission.ethz.ch/master/how_to_apply/required_docs/catf

In addition to the documents required by the ETH admission office, candidates must enclose in their application:

- 2 academic references, including phone numbers and addresses
- letter of purpose (personal motivation statement)
- preferred specialization track
- GRE General Test

Optional:

- preferred Mentor
- GRE subject test in Computer Science

Furthermore, candidates are recommended to submit additional information that might be relevant for the evaluation of their application (e.g. scientific or technical publications or awards, previous graduate studies, professional experience, etc.).

3.6 Official Enrolment at ETH

ETH bachelor students can enroll online for the Master's program at www.einschreibung.ethz.ch. One cannot undo the enrolment in the Master's program. Once students enroll, they have 3 years time to finish their Master's including the Master's thesis.

Students coming from universities other than ETH will get all required information about enrolment and on-line registration for courses by mail. Enrolment and registration for the courses have to be completed by the end of the second semester week at the latest.

3.7 Internal Registration at the Department of Computer Science

The signed *personal study* plan and the *internal registration form* have to be handed in to the Student Administration Office by the end of the second semester week at the latest. Both documents can be found online at the end of the description of the admission requirements of every category of students. For the corresponding link please see in the sections 3.1-3.5.

Each student is responsible for composing his or her own study plan for the full Master's program. In doing so, you must make sure that you obtain enough points in each course category. For the course categories and the minimal points required see section 2.3. You also have to follow the guidelines given by the chosen specialization track.

The personal study plan must be discussed with the mentor. We recommend filling in the personal study plan and then contacting a possible mentor. If the mentor approves the personal study plan, you can internally register at the Department of Computer Science.

4 How to Study at ETH Zurich

4.1 Our Teaching System

4.1.1 How to register for a course?

All courses of the ETH can be found in the online course catalogue at *www.vorlesungsverzeichnis.ethz.ch* or *www.inf.ethz.ch/education/courses*

In generally all courses are open to all students. There are no restrictions regarding the number of students attending the courses except for seminars. Students just have to register for the course online. Every enrolled student has an account that enables for online registration to courses *www.einschreibung.ethz.ch*

During the semester you will be requested to register for the exams. After having registered for the exams you still are allowed to withdraw the registration until a given deadline.

4.1.2 Course Components

The courses are usually split in two parts, a lecture component and an exercise component. In the lectures students get the theoretical background of the course subject. For practice, exercise sheets are handed out. These exercises have to be solved by the students and they will be discussed in the exercise lessons. The exercise classes are taught by teaching assistance. While in the lecture the full class is taught by the lecturer, the class is divided into smaller groups for the exercise lessons. That makes the exercise classes to a good place to discuss problems and ask question. The teaching assistant is the first person to contact for questions concerning subject matters.

It is strongly recommended to work on these exercises. The exams are often similar to the exercises.

4.1.3 Exams

Exams are hold at the end of each course. The information concerning exam dates, examination form (oral or written) and language are communicated in the lectures.
Ratings are either given by a grade, passed / failed or sufficient / insufficient. The maximal grade is 6, the minimal grad is 1. The minimal grade for passing an exam is 4.
Each exam can only be taken twice.

4.1.4 Grading System

In Switzerland, a 6-point grading scale similar to that in Germany is used, but in reverse order and with a higher failing grade.

Grade	Meaning
6	(very good) is the best possible grade
5	(good) is a good grade
4	(sufficient) is the lowest grade that suffices to pass an exam
3	(insufficient) is a failing grade
2	(poor) is a low failing grade
1	(very poor) is the worst possible grade

Every grade below 4 is a failing grade, so a '3.9' is considered insufficient. In exams, quarter steps are usually used to indicate grades in between integer grades, for example '5.25'. Sometimes, finer grained systems are used with steps of one tenth. This is often the case in exams where the grade is a linear function of the number of achieved points (Grade = achieved_point/max_points*5 + 1).

4.1.5 ECTS Points

One of the objectives of the Bologna Reform is to establish a unique system of credits as a suitable and recognized means of promoting the most widespread student mobility. The document *Guidelines for the Renewal of Teaching at Swiss Universities under the Framework of the Bologna Process - Dec 4, 2003* describes how Swiss universities are to award credit points under the European Credit Transfer and Accumulation System (ECTS).
ECTS is based on the workload required to fulfill the objectives of a program. Its main convention is that 60 credits measure the workload of a full-time student during one academic year. The workload of a full-time study program in Europe amounts to 36-40 weeks per year. Under such assumptions, one credit stands for 25-30 working hours. "Workload" refers to the notional time an average student may need to complete the required learning outcomes, including the time spent in attending lectures or seminars, studying independently, and preparing for and writing of examinations.
Credits can only be awarded after the successful completion of the necessary performance assessment. No credit points are awarded for unsatisfactory performance. Partial awarding of credit points is not permitted.

4.2 Language Requirements

Courses in the bachelor program are often taught in German, especially additional courses out of the first two years. Since additional required courses are courses from the bachelors program it is advisable for master students to know German. Most of "Multidiscipline subjects" that are taught in German besides of a few exceptions that are in English only.

Courses in the Master's program are usually taught in English and also the course material is in English. Hence good knowledge of English is required.

4.3 Infrastructure

4.3.1 Technical

The computer science department provides an up-to-date infrastructure. Several computer rooms are open for all students. The computers in there are provided with the latest computer software. However, many students work with their personal notebook. Docking-stations and WLAN in all buildings enable students to connect to the internet. Notebooks can be bought at a reduced rate (see http://www.neptun.ethz.ch).

4.3.2 Library

The ETH has a really good equipped central library. And additionally every department at the ETH has a special library. The library of the computer science department is, as all other libraries, open to all students. This library is growing continuously and is exerted to have all relevant books. The students have online access to all books available through the *nebis*-network (www.nebis.ch).

4.4 Living in Zurich

4.4.1 The city

Zurich with its 350'000 inhabitants (or almost one million in the metropolitan area) is the largest city of Switzerland. While Berne is the political capital, Zurich is considered the business capital. Formerly an industrial town, the focus is shifting to commercial business. With its schools of all levels, theatres, concert halls, museums, art galleries, libraries and bookshops, Zurich is also a center of cultural importance. Its situation between hills at a lake, within easy reach of the alps and other places of interest, makes it a pleasant but, relatively expensive place to live.
Zurich has excellent air, rail and road connections. Euro City and Inter City trains from all directions stop at the central station (Hauptbahnhof). Within the metropolitan area, there is a combined network of public transportation (called Verkehrsverbund), linking rapid suburban rail (S-Bahn), tramways, buses and boats. There is an information centre at the central station.

4.4.2 Residence permit

Citizens of the European Union need not do anything before their arrival. Citizens of other countries will be supported by the Student Exchange Office to obtain the residence permit. Details will be sent to you with the letter of acceptance.

4.4.3 Health insurance

Swiss law requires that all persons residing in Switzerland for more than three months be covered by adequate health insurance. Students coming within a mobility program may - under certain circumstances - be exempted. There is a special procedure for students from EU and EFTA countries. Students from other countries will receive information during their application procedure. There exists a Health Insurance Advisory Service of the University and ETH.

4.5 Useful Links

ETH:

http://www.ethz.ch	ETH Zurich
http://www.inf.ethz.ch	Department of Computer Science
http://www.admission.ethz.ch	Admission Information
http://www.study.ethz.ch	International Student Information from ETH Zurich
http://www.international.ethz.ch	International Students of ETH
http://www.vorlesungsverzeichnis.ethz.ch	Course catalog
http://www.inf.ethz.ch/education/programs/master	Master's Program

Switzerland:

http://www.zuerich.ch	Information about Zurich
http://www.ch.ch/private	Information about Switzerland (Government)

Students Organization:

http://www.vis.ethz.ch	Association of Computer Science Students
http://forum.vis.ethz.ch	Discussion Board