Guidelines to the Master Program

in Computer Science

Faculty of Science,

University of Basel

Department of Mathematics and Computer Science, Spiegelgasse 1, CH – 4051 Basel
Phone: +41 61 267 05 45, E-mail: informatik@unibas.ch
https://dmi.unibas.ch/en/academics/computer-science/

This document is the English translation of an excerpt of the «Wegleitung für die Bachelor- und Masterstudiengänge in Computer Science» (Chapter 1, 3, 4, 5 and 6), which has been approved by the Faculty on 21 May 2019. In case of doubt, please refer to the original German version, which is the legally binding document.

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1 Overview

The University of Basel offers a course in Computer Science which is divided into a 3-year Bachelor's program and a 1.5-year Master's program. This guideline explains and supplements the official study regulations *Ordnung für das Bachelorstudium Computer Science an der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel* (05.12.2015) and the *Ordnung für das Masterstudium Computer Science an der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel* (05.12.2015), in the following referred to as *Bachelorstudienordnung* and *Masterstudienordnung* (BSO and MSO).

The guidance will point out the relevant paragraphs of the study regulations in square brackets, e.g., [BSO § 10.1].

1.1 Profile

The Computer Science program of the University of Basel opens a wide range of career opportunities in business and industry, but it also provides the theoretical knowledge for doing research. The graduates of the Computer Science program are able to analyse problems systematically and can independently develop solutions with the aid of information and communication technologies. They not only know about the current state of the art in Computer Science, but are also prepared to deal autonomously with the continual changes within the field. Working and programming in teams as well as discussing and presenting solutions prepare the students for professional life.

1.2 Offered Degrees

The University of Basel offers three degrees in Computer Science (see Figure 1):

1. **Bachelor of Science in Computer Science** (see German *Wegleitung*) (3 years)
2. **Master of Science in Computer Science, Major in Distributed Systems** or **Master of Science in Computer Science, Major in Machine Intelligence** (1.5 years)
3. **Dr. phil. in Computer Science / PhD in Computer Science** in one of the research areas of the section of Computer Science

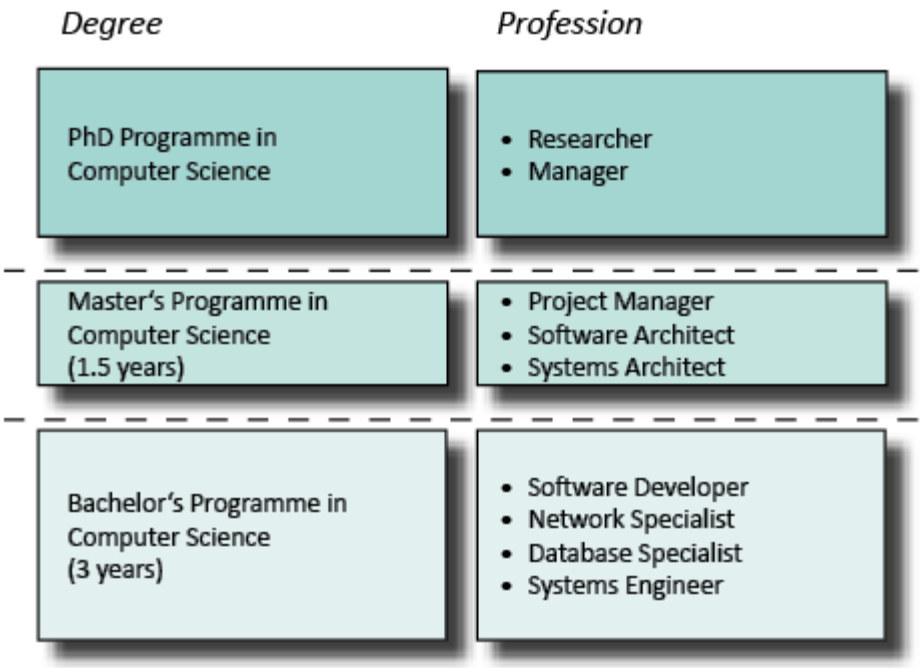

Figure 1: Overview Computer Science.

1.3 Start of the Programs

The Bachelor's program can only be started in the autumn semester [BSO § 4]. The Master's program can be started either in the autumn or in the spring semester [MSO § 4], but starting in the autumn semester is recommended.

1.4 Credit Points and Duration of the Programs

The programs in Computer Science at the University of Basel are structured according to the declaration of Bologna and are internationally recognized. Credit points (CP) can be obtained after the successful participation in courses. To be awarded the Bachelor's degree, students must have obtained 180 credit points. The Master's degree requires 90 additional credit points.

The credit points are calculated according to the European Credit Transfer System (ECTS). The basic idea of this credit point system is to make the learning effort during the studies more transparent and internationally comparable. The credit point system provides a measure for the average workload during one year of full-time studies. The European credit point system assumes that full-time students work 45 hours during 40 weeks for their studies (=1800 hours per year). This annual study time corresponds to 60 credit points, i.e., 1 CP is awarded for 30 hours of studying (attendance of courses plus homework). By assigning credit points to individual courses the expected amount of work becomes apparent. Thus studies become more transparent, better plannable and are easier to evaluate in case of a transfer to another university.

In principle, there are no regulations as to within which period of time the necessary credit points have to be obtained. The 180 CP for the Bachelor's degree can be obtained during 3 years of full-time studies. However, the credit points can also be obtained during a longer, self-determined time period. This allows, for example, an employment parallel to the studies or an extension of the studies for family reasons.

1.5 Examinations

For acquiring credit points, the regulations for the Bachelor's and Master's programs provide different forms of examinations. With few exceptions, the examinations in each course are oral or written. A detailed description can be found in the *Ordnung für die Bachelor- und Masterstudiengänge an der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel* (short: *Rahmenordnung* Fakultät Phil-Nat, RO under [RO §§ 8–16]).

Please note that the examination in a main lecture («Hauptvorlesung») is a main lecture exam. A failed main lecture exam can only be repeated once. The repeat exam has to be taken within one year. If there is no rule in the guidelines for compensating the credit points, the second failure of the exam leads to the exclusion from all degrees in which this exam is mandatory.

The online course directory shows which lectures are main lectures.

2 Bachelor's Program Computer Science

Please see the Guidelines in German.

3 Master's Program Computer Science

The Master's program can be started either in the autumn or in the spring semester [MSO § 4] (start in the autumn semester is recommended) and can be completed after one and a half years of full-time study or longer part-time study. After the successful completion of the Master's program, the degree *Master of Science in Computer Science* with specialization (Major) *Distributed Systems* or *Machine Intelligence* is awarded. The language of instruction is English.

3.1 Admission to the Master's Program

Students holding a Bachelor's degree in Computer Science from a university in Switzerland are directly admitted to the Master's program in Computer Science.

Students with a Bachelor's degree in Computational Sciences, Mathematics, Physics or Nanosciences from the University of Basel and students with the Bachelor of Arts in Computer Science from the Faculty of Humanities of the University of Basel are admitted to the Master's program in Computer Science. Admission is without additional requirements if they have acquired at least 30 credit points in Computer Science from the following courses:

Mandatory:

- **(+)** Grundlagen der Programmierung (10890, 4 KP)
- **(+)** Übung Erweiterte Grundlagen der Programmierung (45398, 4 KP)
- **(+)** Programmierprojekt (27065, 6 KP)

One of these two courses:

- Algorithmen und Datenstrukturen (8 KP)
- Theory of Computer Science (8 KP)

One of these five courses:

- Computer Architecture and Operating Systems (8 KP)
- Introduction to Internet and Security (8 KP)
- Databases (8 KP)
- Pattern Recognition (8 KP)
- Foundations of Artificial Intelligence (8 KP)

Admission to the Master's Program in Computer Science for all other Master candidates is given by the Rectorate on request of the Faculty's Examination Board [RO § 3]. To obtain admission to the Master's Program with a degree of a Swiss or international university of applied sciences or school for teacher education (both of, which must be recognized by the University of Basel), a grade average at least 5.0 (Swiss grading system) is required.

3.2 Modules of the Master's Program

The Master's Program is structured into the two specialization fields *Distributed Systems* and *Machine Intelligence* and includes at least 90 credit points.

3.2.1 Major Distributed Systems

The Master's program with a major in Distributed Systems comprises the modules «Concepts of Distributed Systems», «Methods of Distributed Systems» and «Applications of Distributed Systems» and the components outlined in section 3.2.3 (preparation of Master's thesis, Master's thesis, Master's exam). Figure 3 shows an overview of the Master's program with major Distributed Systems.

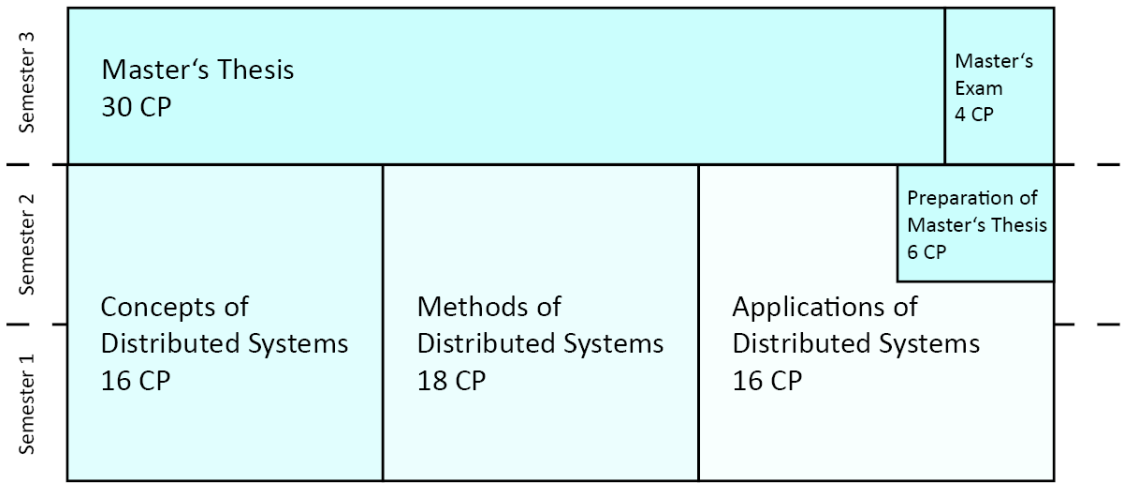

Figure 3: Modules of the Master's program Computer Science, major Distributed Systems.

In the Master's program failed courses cannot be compensated. Only passed credit requirements can be counted. Mandatory courses are marked with (+).

3.2.1.1 Module Concepts of Distributed Systems (16 KP)

This module contains the core courses and intends to convey the central concepts of Distributed Systems. The following courses are offered regularly:

- **(+)** Foundations of Distributed Systems (45402, 8 CP)
- Computer Networks (15728, 4 CP)
- Distributed Information Systems (15729, 4 CP)
- High Performance Computing (17164, 4 CP)

Furthermore, additional courses connected to this module may be offered. They can be found in the online course directory.

«Foundations of Distributed Systems» is a mandatory lecture and the other lectures in this module build on it. It is recommended to attend this course as early as possible in the Master's program. Two of the three specialization courses (each with 4 CP) can be credited in this module. Students who attend all three specialization courses can credit the third one in the module «Applications of Distributed Systems».

3.2.1.2 Module Methods of Distributed Systems (18 KP)

This module conveys methodical skills enabling the students to apply the acquired knowledge from the module «Concepts of Distributed Systems». The aim is to practice exact scientific procedures and self-directed execution of projects in the research area of Distributed Systems. The following courses are offered regularly:

- **(+)** Seminar Scientific Writing (17163, 6 CP)
- **(+)** *Project in the area of Distributed Systems (learning contract, 6 or 12 CP)
- Multimedia Retrieval (15731, 6 CP)

Furthermore, there can be additional courses linked to this module. They can be found in the online course directory.

*The project is a mandatory component of this module and can be conducted with the scope of 6 CP or 12 CP.

The project is not announced in the course directory. Instead, a learning contract is arranged by individual agreement with the lecturers of the specialization area Distributed Systems. The lecture Multimedia Retrieval can alternatively be used for the module Applications of Distributed Systems.

3.2.1.3 Module Applications of Distributed Systems (16 KP)

In this module courses can be chosen freely, which deepen or complement the foundational knowledge from the module «Concepts of Distributed Systems» and the methodical competences from the module «Methods of Distributed Systems». The set of offered courses can change from semester to semester (please consult the online course directory). Students who attend all three specialization courses of the module «Concepts of Distributed Systems» can credit the third one in the module «Applications of Distributed Systems». Apart from related courses from the area of Distributed Systems, students can also choose courses from the specialization area Machine Intelligence, which are linked to this module (please consult the online course directory).

3.2.1.4 Example (Major Distributed Systems)

Schedule 2 shows exemplarily how to complete the Master's program Computer Science, Major Distributed Systems, within 3 semesters, beginning in the autumn semester. In this example, 18 CP are

acquired in the module «Applications of Distributed Systems» instead of the minimally required 16 CP. For a possible variation with 16 CP «Probabilistic Shape Modelling» could be chosen in the second semester instead of «Planning and Optimization» in the first semester.

Schedule 2: Example for Master's program Computer Science, major Distributed Systems starting in the autumn semester.

Sem.	*Module*	*Lecture*	*CP*
1 (AS)	Concepts of Distributed Systems	Foundations of Distributed Systems	8
	Methods of Distributed Systems	Scientific Writing	6
	Applications of Distributed Systems	Multimedia Retrieval	6
		Planning and Optimization	8
2 (SS)	Concepts of Distributed Systems	Computer Networks	4
		Distributed Information Systems	4
	Methods of Distributed Systems	Project in module Distributed Systems	12
	Applications of Distributed Systems	High Performance Computing	4
		Preparation of Master's thesis	6
3 (AS)		Master's thesis	30
		Master's exam	4
Total			*92*

3.2.2 Major Machine Intelligence

The Master's Program with major Machine Intelligence contains the modules «Concepts of Machine Intelligence», «Methods of Machine Intelligence» and «Applications of Machine Intelligence» and the components outlined in section 3.2.3 (preparation of Master's thesis, Master's thesis, Master's exam). Figure 4 shows an overview of the modules of the Master's program with major Machine Intelligence.

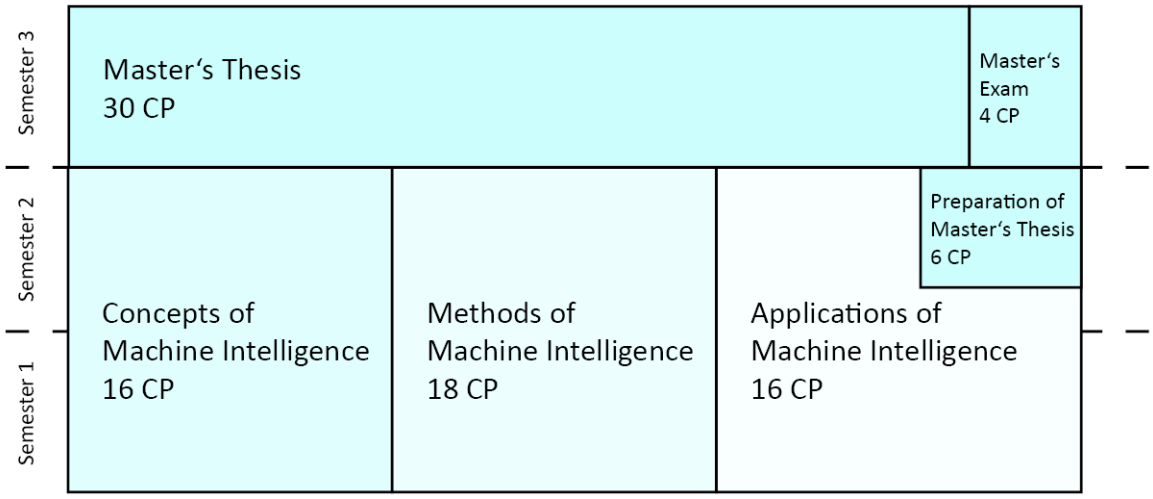

Figure 4: Modules of the Master's Program Computer Science, major Machine Intelligence.

In the Master's program failed courses cannot be compensated. Only passed credit requirements can be counted. Mandatory courses are marked with (+).

3.2.2.1 Module Concepts of Machine Intelligence (16 CP)

This module contains core courses intending to convey the central concepts of Machine Intelligence. The following courses are offered regularly:

- Machine Learning (17165, 8 CP)
- Planning and Optimization (45400, 8 CP)

Furthermore, there can be additional courses linked to this module. They can be found in the online course directory.

3.2.2.2 Module Methods of Machine Intelligence (18 CP)

This module conveys methodical skills enabling students to apply the acquired knowledge from the module «Concepts of Machine Intelligence». The aim is to practice exact scientific procedures and self-directed execution of projects in the research area of «Machine Intelligence». The following courses are offered regularly:

- **(+)** Scientific Writing (17163, 6 CP)
- Seminar Machine Intelligence (45366, 6 CP)
- Probabilistic Shape Modelling (43075, 6 CP)

Furthermore, there can be additional courses linked to this module. They can be found in the online course directory.

In addition to the related courses from the course directory, students can gain credit points with an individual project in the area of Machine Intelligence. A learning contract is arranged by individual agreement with the lecturers of the specialization area Machine Intelligence.

3.2.2.3 Module Applications of Machine Intelligence (16 CP)

In this module, courses can be chosen freely wich deepen or complement the foundational knowledge from the module «Concepts of Machine Intelligence» and the methodical competences from the module «Methods of Machine Intelligence». The set of offered courses can change from semester to semester (please consult the online course directory). Apart from the related courses from the area Machine Intelligence, students can also choose courses from the specialization area Distributed Systems, which are linked to this module (please consult the online course directory).

3.2.2.4 Example (Major Machine Intelligence)

Schedule 3 shows exemplarily, how to complete the Master's program Computer Science, major Machine Intelligence, within 3 semesters, beginning in the autumn semester. In this example, «Computer Networks» was chosen arbitrarily in the module «Applications of Machine Intelligence» in the second semester. Instead of this, the two other courses from Distributed Systems or other linked courses can be chosen.

Schedule 3: Example for the Master's Degree Computer Science, major Machine Intelligence starting in the autumn semester.

Sem	*Module*	*Lecture*	*CP*
1 (AS)	Concepts of Machine Intelligence	Planning and Optimization	8
	Methods of Machine Intelligence	Scientific Writing	6
	Applications of Machine Intelligence	Bioinformatics Algorithms	4
		Foundations of Distributed Systems	8
2 (SS)	Concepts of Machine Intelligence	Machine Learning	8
	Methods of Machine Intelligence	Seminar Machine Intelligence	6
		Probabilistic Shape Modelling	6
	Applications of Machine Intelligence	Computer Networks	4
		Preparation of Master's Thesis	6
3 (AS)		Master's Thesis	30
		Master's Exam	4
Total			*90*

3.2.3 Master's thesis and Master's examination

In addition to the modules «Concepts», «Methods» und «Applications» the following components are required in both specialization fields:

- Preparation of Master's thesis (6 CP)
- Master's thesis (30 CP)
- Master's exam (4 CP)

The **preparation of the Master's thesis** is conducted within the elected major. Usually, the preparation is scheduled in the second term, after the end of the lecture period and serves as an orientiation into the subject of the Master's thesis.

Together with a professor from the elected field of specialization students arrange a learning contract for the preparation of the Master's thesis (6 CP). The learning contract defines the subject, start date, end date and form of submission of the preparation of the Master's thesis. It should be possible to finish the preparation of the Master' thesis working full-time within one month. The grading is pass/fail.

The **Master's thesis** is also conducted within in the elected major. The thesis can only be started after successfully finishing the preparation of the Master's thesis and after having gained a minimum of 42 CP in the modules of the chosen major.

The Master's thesis usually takes 6 months. The written report of the Master's thesis must be submitted electronically and the results have to be presented in a 30-minute presentation, which is open to all members of the University. Details on the subject, the submission, the length, start and end date are arranged in a learning contract. The Master's thesis is graded (1.0 – 6.0). A failed Master's thesis can be repeated once, with a new subject.

The **Master's exam** takes place after finishing the Master's thesis. Subject of the exam is the accumulated scientific knowledge within the elected major. It is an oral exam, takes 20 minutes and is graded (1.0-6.0). Submitting a written application for the Master's exam to the Computer Science degree program coordinator is mandatory (at least 3 weeks before the date of the exam). Usually, the Master's exam takes place directly after the presentation of the Master's thesis.

Details on the preparation, the Master's thesis and the exam can be found in the *Ordnung für das Masterstudium Computer Science an der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel* [MSO §§ 10-12].

3.3 Completion of Master's degree and grade

To acquire the Master's degree the required credit points have to be reached in each module. In the Master's program there is no compensation of failed courses.

All modules are graded, except for the preparation of the Master's thesis. The grade of every module is calculated by taking the average weighted by the credit requirements of the graded academic achievements [MSO § 8.2]. The final grade is calculated by taking the weighted average of the grades of the modules, the Master's thesis and the Master's exam with the following weights [MSO § 8.3]:

- Module Concepts of Distributed Systems/Machine Intelligence: 20%
- Module Methods of Distributed Systems/Machine Intelligence: 20%
- Module Applications of Distributed Systems/Machine Intelligence: 10%
- Master's Thesis: 45%
- Master's Exam: 5%

4 Quality Assurance

The quality of the offered courses is regularly evaluated according to the guidelines of course evaluation at the Faculty of Science of the University of Basel.

5 Validity

The presented guideline is valid for all Master students who have enrolled on August 1, 2016 or later.

6 Further Information and Course Guidance

Degree Program Coordinator, Student Advisory Service
Dr. Heike Freiberger
E-mail: heike.freiberger@unibas.ch
The Degree Program Coordinator is responsible for the student advisory service, provides information about program structure, study focus, credit transfer, mobility and questions about student regulations and guidelines.

Website Computer Science
https://dmi.unibas.ch/en/academics/computer-science/

Head of the Curriculum Commission Computer Science
Prof. Dr. Malte Helmert
E-mail: malte.helmert@unibas.ch

Dean's Office of the Faculty of Science
(Dean, Examination Office, Examination Commission)
Klingelbergstrasse 50
4056 Basel
Tel.: +41 (0) 61 267 30 54
E-mail: studiendekanat-philnat@unibas.ch
https://www.philnat.unibas.ch

Student Office of the University of Basel
Petersplatz 1
4001 Basel
Tel.: +41 (0) 61 267 30 23
https://www.unibas.ch/en/Studies/Application-Admission.html