

Appendix 1a
Description of Compulsory Modules

Module Number	Module Name	Responsible Lecturer
MCL-F	Foundations	Prof. Steffen Hölldobler
Content and Qualification Objectives	The content of the module encompasses the propositional logic, the first level predicate logic, the closing under equality, the deductive, abductive and inductive closing, the non-monotonic closing, machine learning, logic-based programme development, the processing of natural language and neuro-symbolic integration. At the end of this module, the students will acquire the methodological principles of the propositional logic and the first level predicate logic. They will also become familiar with the breadth of the computational logic field, and the basic techniques and methods used in important sub-areas.	
Teaching and Learning Methods	The module includes 4 hours of lectures and 4 hours of exercises per week, as well as self-directed studies. The educational events will be announced at the beginning of each year of study, by stating the teaching methods and their respective weekly hours per semester (WHS), within the framework of the course offer, as offered by the Department of Computer Science for the	
Participation Prerequisites	None	
Application	This module is a compulsory module, within the Master of Computational Science programme. Completion of this module fulfils the prerequisite for the modules Advanced Logics (MCL-AL), Integrated Logic Systems (MCL-ILS) and Project(MCL-P).	
Requirements for Earning Performance Points	The performance points will be earned upon successful passing of the module examination. The module examination consists of a written examination of 90 minutes and an oral examination of 20 minutes.	
Performance Points and Grades	By completing this module, students may earn 8 performance points. The module score is the unweighted average of the grades earned in the individual examinations.	
Module Offer Frequency	The module is offered each year during the Winter semester.	
Workload	The workload is a total of 240 hours.	
Duration of the Module	The module takes 1 semester to complete.	

Module Number	Module Name	Responsible Lecturer
MCL-LCP	Logic and Constraint	Prof. Sebastian Rudolph
Content and Qualification Objectives	<p>The contents of this module are syntax, semantics and computational aspects of logical programmes with different expressive strengths; modelling problems as constraint programmes and techniques for solving them; practical use of logic and constraint programming. Through this module, the students will have an in-depth understanding of the theoretical principles of logic and constraint programming as well as in-depth knowledge of a logical programming language and the ability to systematically design logic programmes, develop constraint solvers, and model application problems as constraint programmes. They will know the areas of application of logic - and constraint programmes, as well as an understanding of the execution of logic programmes.</p>	
Teaching and Learning Methods	<p>The module includes 3 hours of lectures and 4 hours of exercises per week, as well as self-directed studies. The educational events will be announced at the beginning of each year of study, by stating the teaching methods and their respective weekly hours per semester (WHS), within the framework of the course offer, as offered by the Department of Computer Science for the Computational Logic programme.</p>	
Participation Prerequisites	None	
Application	<p>This module is a compulsory module, within the Master of Computational Science programme. Completion of this module fulfils the prerequisite for the modules Advanced Logics (MCL-AL), Integrated Logic Systems (MCL-ILS) and Project (MCL-P).</p>	
Requirements for Earning Performance Points	<p>The performance points will be earned upon successful passing of the module examination. The module examination consists of a written final examination of 120 minutes.</p>	
Performance Points and Grades	<p>By completing this module, students may earn 8 performance points. The module score is equal to the grade earned in the final</p>	
Module Offer Frequency	<p>The module is offered each year during the Winter semester.</p>	
Workload	<p>The workload is a total of 240 hours.</p>	

Duration of the Module	The module takes 1 semester to complete.
-------------------------------	--

Module Number	Module Name	Responsible Lecturer
MCL-AL	Advanced Logics	Prof. Christel Baier
Content and Qualification Objectives	<p>The contents of the module are selected aspects of logic in computer science, depending on the student's choice. Possible topics for the lectures held in this module are elaborations on the propositional- and predicate logic (e.g. description logic, modal and temporal logic, non-monotonic logic, fuzzy logic, quantitative logic, second or higher order logic), algorithmic-, complexity- or model-theoretical explorations and/or applications of mathematical logic (e.g. logic programming, ad theorem proof, knowledge representation, machine learning, verification). The students will have in-depth knowledge of the fundamental principles of logical calculus and can formally investigate mathematical logic regarding its relevant aspects of computer science.</p>	
Teaching and Learning Methods	<p>The module includes lectures, practical exercises, and seminars, for a total scope of 6 WHS, as well as self-directed studies; from which a minimum of 4 hours are spent in lectures. The educational events will be announced at the beginning of each year of study, by stating the teaching methods and their respective weekly hours per semester (WHS), within the framework of the course offer, as offered by the Department of Computer Science for the Computational Logic programme.</p>	
Participation Prerequisites	<p>Competencies from the modules Foundations (MCL-F) and Logic and constraint programming (MCL-LCP), as well as general basic knowledge at the level of a Bachelor's degree in computer science, especially in the fields of the computability and complexity theory, formal languages, algorithms and data structures, are required.</p> <p>References: Hopcroft, J., Motwani, R. & Ullman, J. (2001). Introduction to Automata Theory, Languages and Computation (3d ed.). Pearson.</p>	
Application	<p>This module is a compulsory module, within the Master of Computational Science programme. Completion of this fulfils the prerequisite for the module project.</p>	
Requirements for Earning Performance Points	<p>The performance points will be earned upon successful passing of the module examination. The module examination consists of a final oral examination of 30 minutes.</p>	

Performance Points and Grades	By completing this module, students may earn 8 performance points. The module score is equal to the grade earned in the final oral examination.
Module Offer Frequency	The module is offered each year during the Summer semester.
Workload	The workload is a total of 240 hours.
Duration of the	The module takes 1 semester to complete.

Module Number	Module Name	Responsible Lecturer
MCL-ILS	Integrated Logic Systems	Prof. Franz Baader
Content and Qualification Objectives	<p>The contents of this module are methods and tools for the design, realisation and implementation of practice-relevant logic-based systems. They include topics on formal foundations such as deduction, proof theory, and automatic evidence for common logic formalisms, as well as practical aspects such as automated tools and applications of computational logic. Through this module, the students will have an in-depth understanding of the theoretical principles and applications of integrated logic-based systems. In particular, they will have the ability to understand the functioning of such systems fundamentally, and to develop them themselves. Additionally, they will have the ability to model problems from application areas of computer science for the use of such systems.</p>	
Teaching and Learning Methods	<p>The module includes 3 WHS of lectures and 3 WHS of exercises per week, as well as self-directed studies. The educational events will be announced at the beginning of each year of study, by stating the teaching methods and their respective weekly hours per semester (WHS), within the framework of the course offer, as offered by the Department of Computer Science for the</p>	
Participation Prerequisites	<p>Competence from the Foundations (MCL-F) and Logic and constraint programming (MCL-LCP) modules are required.</p>	
Application	<p>This module is a compulsory module, within the Master of Computational Science programme. Completion of this fulfils the prerequisite for the module project.</p>	
Requirements for Earning Performance Points	<p>The performance points will be earned upon successful passing of the module examination. The module examination consists of a written final examination of 120 minutes.</p>	
Performance Points and Grades	<p>By completing this module, students may earn 8 performance points. The module score is equal to the grade earned in the final</p>	
Module Offer Frequency	<p>The module is offered each year during the Summer semester.</p>	
Workload	<p>The workload is a total of 240 hours.</p>	
Duration of the	<p>The module takes 1 semester to complete.</p>	

Module Number	Module Name	Responsible Lecturer
MCL-CS	Communication Skills	Programme Director
Content and Qualification Objectives	<p>The module includes communication techniques, as well as interdisciplinary content, such as foreign languages or other interdisciplinary events offered by the programme director. At the end of the module, the students know the technical, methodical and interdisciplinary contents of Computer Science. They will also have competencies in subject-related work, as well as in the active application of a foreign language. This knowledge also supports critical thinking and a stronger social orientation. The students will acquire skills of team-working and research-oriented thinking.</p>	
Teaching and Learning Methods	<p>Depending on the student's choice, the module includes language courses or other teaching events, as shown in the catalogue MCL-CS, in the total scope of 4 WHS, as well as self-study. The lectures are to be selected from the MCL-CS catalogue as specified; this will be announced at the beginning of each semester, in writing, including the necessary examination scores, the weighting of the grades and the course language.</p>	
Participation Prerequisites	None	
Application	<p>This module is a compulsory module, within the Master of Computational Science programme. Completion of this module fulfils the prerequisite for the modules PresentationSkills (MCL-</p>	
Requirements for Earning Performance Points	<p>The performance points will be earned upon successful passing of the module examination. The module test consists of the examination performance specified by the MCL-CS catalogue.</p>	
Performance Points and Grades	<p>By completing this module, students may earn 4 performance points. The module score is the weighted average of the grades earned in the individual examinations, as specified in the MCL-CS catalogue.</p>	
Module Offer Frequency	<p>The module is offered each year during the Winter semester.</p>	
Workload	<p>The workload is a total of 120 hours.</p>	
Duration of the	<p>The module takes 2 semesters to complete.</p>	

Module Number	Module Name	Responsible Lecturer
MCL-PS	Presentation Skills	Programme Director
Content and Qualification Objectives	The module covers the practical utilisation of writing- and presentation-techniques. At the end of the module, the students will be familiar with the technical, methodical and scholarly contents of Computer Science. They will also have competencies in subject-related work, as well as in the active application of subject-related work. This knowledge also supports critical thinking and a stronger social orientation. The students will acquire skills of team-working and research-oriented thinking.	
Teaching and Learning Methods	The module includes 4 WHS of seminars, as well as self-directed studies. The educational events, with details of the teaching methods and their respective WHS, are to be selected in the scope as specified in the MCL-PS catalogue; including the necessary examination and grading weights as part of the course offer by the Faculty of Computer Science for the Computational Logic programme, at the beginning of each academic year.	
Participation Prerequisites	The competencies acquired in Module Communication Skills (MCL-CS) are required.	
Application	This module is a compulsory module, within the Master of Computational Science programme.	
Requirements for Earning Performance Points	The performance points will be earned upon successful passing of the module examination. The module test consists of the examination performance specified by the MCL-PS catalogue.	
Performance Points and Grades	By completing this module, students may earn 6 performance points. The module score is the weighted average of the grades earned in the individual examinations, as specified in the MCL-PS catalogue.	
Module Offer Frequency	The module is offered each semester.	
Workload	The workload is a total of 180 hours.	
Duration of the Module	It takes 1 semester to complete the module.	

Module Number	Module Name	Responsible Lecturer
MCL-P	Project	Programme Director
Content and Qualification Objectives	Upon completing the module, the students can analyse a simple scientific task and relate it to the state of the Art in the underlying sub-tree; they can solve the task; describe in writing the state of the Art as well as the solution found, present it in a lecture and defend it in a subsequent debate.	
Teaching and Learning Methods	The module includes 4 WHS of projects, as well as self-directed studies.	
Participation Prerequisites	The knowledge provided in the compulsory modules Foundations (MCL-R), Logic and Constraint Programming(MCL-LCP), Integrated Logic Systems (MCL-ILS), Advanced Logics(MCL-AL) and Communication Skills (MCL-CS) of the master program in Computational Logic are acquired	
Application	This module is a compulsory module, within the Master of Computational Science programme.	
Requirements for Earning Performance Points	The performance points will be earned upon successful passing of the module examination. The module examination consists of completing a project of 12 weeks, and a presentation.	
Performance Points and Grades	By completing this module, students may earn 12 performance points. The module score is the average of the grades earned in the individual examinations, weighted as follows: Project work with 3 factors, and presentation with 1 factor.	
Module Offer Frequency	The module is offered each semester.	
Workload	The workload is a total of 360 hours.	
Duration of the	The module takes 1 semester to complete.	

Appendix 1b
Description of Compulsory Modules

Module Number	Module Name	Responsible Lecturer
MCL-AI	Artificial Intelligence (AI)	The Director of the Institute for AI
Content and Qualification Objectives	The content of the module is determined by the student from the subject areas of artificial intelligence, in particular from knowledge representation and inference, computational logic, pattern recognition and computer vision, bioinformatics, machine learning and cognitive sciences. Upon completion of the module, the students can specify intelligent systems using formal methods, methods, and algorithms. They can prove the characteristics of intelligent systems using formal methods, methods, and algorithms. They can introduce the formal methods, methods, and algorithms into further applications, and they can engage in critical arguments with intelligent systems.	
Teaching and Learning Methods	The module includes lectures and practical exercises of 8 WHS, as well as self-directed studies. The teaching events, with the teaching formats and their respective WHS, must be chosen from the MCL-AI catalogue to the extent indicated; this will be announced within the study offered by the Faculty of Computer Science for the Computational Logic programme, at the beginning of each academic year.	
Participation Prerequisites	Basic knowledge of the methods, algorithms, and techniques for intelligent systems is required. References: Russel, S. & Norvig, P. Artificial Intelligence: A Modern Approach. Prentice Hall, 2009.	
Application	This module is one of the optional modules, within the Master of Computational Science programme, of which there are 3 to be chosen.	
Requirements for Earning Performance Points	The performance points will be earned upon successful passing of the module examination. The module examination consists of a final oral examination of 40 minutes.	
Performance Points and Grades	By completing this module, students may earn 12 performance points. The module score is equal to the grade earned in the final oral examination.	
Module Offer Frequency	The module is offered each semester.	

Workload	The workload is a total of 360 hours.
Duration of the Module	The module takes 1 semester to complete.

Module Number	Module Name	Responsible Lecturer
MCL-KR	Knowledge Representation	Prof. Sebastian Rudolph
Content and Qualification Objectives	<p>The contents of the module depend on the student's choice</p> <ol style="list-style-type: none"> 1. Knowledge categories 2. Logic-based formalisms for the representation of knowledge and their mathematical properties 3. Inference methods for the automated processing of knowledge 4. Design of knowledge bases 5. Fundamentals and applications of knowledge-based systems in artificial intelligence (AI). <p>Through this module, students will gain a deeper understanding of the formalisation and handling of knowledge in artificial intelligence (AI). They will obtain competencies in design, formal specification and the realisation of methods in knowledge processing. By emphasising a formal approach in combination with systematic methods of problem modelling and software development, the students will acquire an essential ability for scientific work in computer science.</p>	
Teaching and Learning Methods	<p>The module includes lectures and practical exercises of 8 WHS, as well as self-directed studies. The teaching events, with the teaching formats and their respective WHS, must be chosen from the MCL-KR catalogue to the extent indicated; this will be announced within the study offered by the Faculty of Computer Science for the Computational Logic programme, at the beginning of each academic year.</p>	
Participation Prerequisites	<p>In-depth knowledge of the logic at the level of a bachelor's degree in computer science is required.</p> <p>References: Schöning, U. (2008). Logic for Computer Scientists. Birkhäuser Boston Inc.</p>	
Application	<p>This module is one of the optional modules, within the Master of Computational Science programme, of which there are 3 to be chosen.</p>	
Requirements for Earning Performance Points	<p>The performance points will be earned upon successful passing of the module examination. The module examination consists of a final oral examination of 40 minutes.</p>	

Performance Points and Grades	By completing this module, students may earn 12 performance points. The module score is equal to the grade earned in the final oral examination.
Module Offer Frequency	The module is offered each semester.
Workload	The workload is a total of 360 hours.
Duration of the Module	The module takes 1 semester to complete.

Module Number	Module Name	Responsible Lecturer
MCL-PI	Principles of Inference	Prof. Steffen Hölldobler
Content and Qualification Objectives	The content of the module includes, depending on the student's choice, selected inference techniques in automatic or semi-automatic evidence- and conclusion-systems from logic and calculus to data structures, strategies, heuristics, implementations, and applications. Upon completion of the module, students will have a deep understanding of the development, implementation, and application of selected inference techniques.	
Teaching and Learning Methods	The module includes lectures and practical exercises of 8 WHS, as well as self-directed studies. The teaching events, with the teaching formats and their respective WHS, must be chosen from the MCL-PI catalogue to the extent indicated; this will be announced within the study offered by the Faculty of Computer Science for the Computational Logic programme, at the beginning of each academic year.	
Participation Prerequisites	In-depth knowledge of the logic at the level of a bachelor's degree in computer science is required. References: Hölldobler, S. (2009). Logic and logic programming. 1: Basics. Synchron Publishers GmbH. S. Bader, B., Fronhöfer, U., Hitzler, H. P., Hölldobler, S., Krötzsch, M., T. & Pietzsch, T. (2011). Logic and logic programming. 2: Tasks and Solutions. Synchron Publishers GmbH, Heidelberg.	
Application	This module is one of the optional modules, within the Master of Computational Science programme, of which there are 3 to be chosen.	
Requirements for Earning Performance Points	The performance points will be earned upon successful passing of the module examination. The module examination consists of a final oral examination of 40 minutes.	
Performance Points and Grades	By completing this module, students may earn 12 performance points. The module score is equal to the grade earned in the final oral examination.	
Module Offer Frequency	The module is offered each semester.	
Workload	The workload is a total of 360 hours.	
Duration of the Module	The module takes 1 semester to complete.	

Module Number	Module Name	Responsible Lecturer
MCL-TCSL	Theoretical Computer Science	Prof. Franz Baader
Content and Qualification Objectives	<p>The content of the module includes selected techniques of theoretical informatics (such as automata, decision-making and complexity results, term-translation techniques), as well as their use for the analysis of formal characteristics (such as axiomatisation, proof-theoretical properties, design of inference algorithms and analysis of their properties) of logics (such as temporal logic, description logic, and second-order monadic logic). Upon completion of the module, students will have an in-depth and practically applicable knowledge of the most important methods in theoretical computer science relevant for the application of logic, as well as a deep understanding of the formal characteristics of logics.</p>	
Teaching and Learning Methods	<p>The module includes lectures and practical exercises of 8 WHS, as well as self-directed studies. The teaching events, with the teaching formats and their respective WHS, must be chosen from the MCL-TCSL catalogue to the extent indicated; this will be announced within the study offered by the Faculty of Computer Science for the Computational Logic programme, at the beginning of each academic year.</p>	
Participation Prerequisites	<p>In-depth knowledge of the logic, as well as basic knowledge in the areas of automaton theory, predictability and complexity at the level of a Bachelor's degree in computer science, is required. References: Schöning, U. (2008). Logic for Computer Scientists. Birkhäuser Boston Inc. Hopcroft, J., Motwani, R. & Ullman, J. (2001). Introduction to Automata Theory, Languages and Computation (3d ed.). Pearson.</p>	
Application	<p>This module is one of the optional modules, within the Master of Computational Science programme, of which there are 3 to be chosen.</p>	
Requirements for Earning Performance Points	<p>The performance points will be earned upon successful passing of the module examination. The module examination consists of a final oral examination of 40 minutes.</p>	
Performance Points and Grades	<p>By completing this module, students may earn 12 performance points. The module score is equal to the grade earned in the final oral examination.</p>	

Module Offer Frequency	The module is offered each semester.
Workload	The workload is a total of 360 hours.
Duration of the	The module takes 1 semester to complete.

Module Number	Module Name	Responsible Lecturer
MCL-FE	Free electives	Programme Director
Content and Qualification Objectives	The module includes, at the discretion of the students, topics that are not limited to their own subject areas, such as software development, data security, image processing or multi-media technology. The students must have a basic understanding of questions in another discipline and the ability to work in an interdisciplinary manner.	
Teaching and Learning Methods	The module includes lectures and practical exercises, seminars and Practice for a total of 8 WHS, as well as self-directed studies. The educational events, with details of the teaching methods and their respective WHS, are to be selected in the scope as specified in the MCL-FE catalogue; including the necessary examination and grading weights as part of the course offer by the Faculty of Computer Science for the Computational Logic programme, at the beginning of each academic year.	
Participation Prerequisites	None	
Application	This module is one of the optional modules, within the Master of Computational Science programme, of which there are 3 to be chosen.	
Requirements for Earning Performance Points	The performance points will be earned upon successful passing of the module examination. The module test consists of the examination performance specified by the MCL-FE catalogue.	
Performance Points and Grades	By completing this module, students may earn 12 performance points. The module score is the weighted average of the grades earned in the individual examinations, as specified in the MCL-FE catalogue.	
Module Offer Frequency	The module is offered each semester.	
Workload	The workload is a total of 360 hours.	
Duration of the	The module takes 1 semester to complete.	

