

# **Teaching and Examination Regulations**

## **Master programme in Computer Science (Joint Degree) Faculty of Science**

**Academic year 2018-2019**

B1. programme specific section - general provisions

B2. programme specific section – content of programme

## Section B1: Programme specific – general provisions

### 6. General programme information and characteristics

#### Article 6.1 Study programme information

1.	The programme Computer Science CROHO number 65014 is offered on a full-time basis.	Advice OLC; approval FGV (7.13 i)
1b	The programme is offered in partnership with the University of Amsterdam and leads to a joint degree.	Advice OLC; approval FGV (9.38 b)
1c	The language of instruction is English	Advice OLC; approval FGV (9.38 b)
2.	A unit of study comprises 6 EC or a multiple thereof. The units listed below have a different size: Not Applicable	

#### Article 6.2 Teaching formats used and modes of assessment

1.	The programme uses the teaching formats as specified in the Study Guide.	Advice OLC; approval FGV (7.13 x)
2.	The modes of assessment used per educational component are specified in the Study Guide.	Advice OLC; approval FGV (7.13 l)

### 7. Further admission requirements

#### Article 7.1 Intake date(s)

1	The programme starts twice a year: on September 1 and on February 1.	Advice OLC; approval FGV (9.38 b)
---	--	---

#### Article 7.2 Admission requirements

1.	Students will be admitted to the degree programme if they hold a letter of acceptance, issued by or on behalf of the Faculty Board because they have demonstrated that they meet the knowledge, understanding and skills requirements reflecting the final level of attainment in an academic Bachelor's degree programme.	Partly legal provision & ordinance CvB, see appendix 3. Admission requirements excepted from participation in WHW
2.	The Examination Board will assess each individual application for admission with regard to the admission requirements.	
3.	In addition to the requirements mentioned in the first paragraph, the Examination Board will also assess applications for admission based on the following criteria: a. talent and motivation; b. command of methods and techniques.	
4.	Anyone with a Bachelor's degree in Computer Science from a Dutch university meets the requirements referred to in the first paragraph.	
5.	If the Master's programme consists of various programmes, then a prerequisite may be set for each programme consisting of a completed Bachelor's specialization or minor.	
6.	Those not yet in possession of a Bachelor's degree, but who meet the admission requirements as regards the knowledge, insight and skills specified in paragraph 1,	

may on request be granted conditional admission to the associated Master's programme, insofar as failure to grant admission would result in undue unfairness.	
---	--

[\[Option 1\] Article 7.3 English language requirement for English-language Master's programmes](#)

<p>1. The proficiency requirement in English as the language of instruction can be met if no longer than two years before the start of the programme, the applicant has successfully completed one of the following examinations with at least the scores indicated:</p> <ul style="list-style-type: none"> <li>- IELTS: 6.5</li> <li>- TOEFL paper based test: 580</li> <li>- TOEFL internet based test: 92</li> <li>- Cambridge Advanced English: A, B or C.</li> </ul>	Landelijke gedragscode Internationale studenten
---	--

[Article 7.4 Pre-Master's programme](#)

1. Students with a Bachelor's degree in a field that corresponds to a sufficient extent with the subject area covered by the Master's programme can request admission to the pre-Master's programme.	advies OLC; instemming FGV (9.38 b)
2. A successfully completed pre-Master's programme serves as proof of admission to the specified Master's programme in the subsequent academic year.	advies OLC; instemming FGV (9.38 b)

## 8. Interim examinations and results

[Article 8.1 Sequence of interim examinations](#)

<p>1. Students may participate in interim examinations [or practical exercises] of the components below only if they have passed the interim examination or examinations for the components mentioned hereinafter:</p> <p>Not Applicable</p>	Advies OLC; approval FGV (7.13 h, s & t)
--	--

[Article 8.2 Validity period for results](#)

<p>1. The validity period of the interim examinations and exemptions from interim examinations below, is limited as follows:</p> <p>Not Applicable</p>	Advies OLC; approval FGV (7.13 k)
<p>2. A student may request the Examination Board to extend the validity of an exam. If the exam shows that a student's knowledge is insufficient or outdated, or if the student's skills and insights evaluated in the exam are demonstrably outdated, the Examination Board may impose a supplementary examination, impose a replacement examination or refuse to extend the period of validity.</p>	Legal provision
<p>3. In situations where a limited period of validity applies, the period of validity of examinations may be extended in the event of extenuating circumstances as stipulated in WHW Article 7.51, paragraph 2, with at least the period of allocated financial assistance specified in WHW Article 7.15, paragraph 1.</p>	Legal provision

### Article 8.3. Degree

Degree Students who have successfully completed their Master's final Examination are awarded a Master of Science degree. The degree awarded is stated on the diploma. If it is a joint degree, this will also be stated on the diploma. Track name will be stated on the diploma, either Big Data Engineering; Computer Systems Security; Foundations of Computing and Concurrency; Internet and Web Technology; Parallel Computing Systems or Software Engineering and Green IT if one has successfully completed all the compulsory courses of the specific track; otherwise no track name will be stated on the diploma.

Legal provision

## Section B2: Programme specific – content of programme

### 9. Programme objectives, specializations and exit qualifications

#### Article 9.1 Workload

1. The programme has a workload of 120 EC.	Advice OLC; (7.13 a)
--	-------------------------

#### Article 9.2 Specializations

<p>The programme has the following specializations:</p> <p>BDE: Big Data Engineering</p> <p>CSS: Computer Systems Security</p> <p>FCC: Foundations of Computing and Concurrency</p> <p>IWT: Internet and Web Technology</p> <p>PCS: Parallel Computing Systems</p> <p>SEG: Software Engineering and Green IT</p>	Advice OLC; (7.13 a)
--	-------------------------

#### Article 9.3 Programme objective

<p>The programme aims to provide students with the knowledge, experience and insight they need to pursue a career as a computer science specialist or to engage in scientific research. Moreover, the programme seeks to provide students with a practical understanding of the field of Computer Science in a broad scientific, philosophical and social context.</p> <p>The goal of the programme is to expand on the knowledge and skills acquired at Bachelor's level. By choosing a specialization, the student engages with the cutting-edge of scientific endeavour or of application and design.</p>	Advice OLC; (7.13 a)
--	-------------------------

#### Article 9.4 Exit qualifications

<p>1. A graduate of the Master's programme in Computer Science:</p> <ul style="list-style-type: none"> <li>• Possesses solid academic knowledge and insight in the field of computer science, including the required background knowledge from other academic disciplines, which builds upon and goes beyond the level of a Bachelor's degree;</li> <li>• Has knowledge, insight and skills of a specialist nature in at least one area of computer science (additional final attainment levels to be given for each specialization separately);</li> <li>• is able to acquire specialist knowledge, insights and skills in other areas of computer science within a reasonable period of time;</li> <li>• has acquired practical skills in relevant sub-areas of the field of computer science at Master level;</li> <li>• is aware of the applications of computer science in general and of the chosen specialization in particular, and is able to apply his/her knowledge and skills to new or otherwise unknown problems;</li> <li>• is capable of designing a research or project plan on the basis of a realistic problem description in the field of computer science and can contribute to its progress with original solutions;</li> <li>• able to carry out research independently, both individually and in small teams.</li> <li>• is able to consult and use the international professional literature in the relevant sub-areas of the field of computer science;</li> <li>• is able to formulate, analyse and evaluate scientific results, and to use them to draw conclusions;</li> </ul>	Approval OLC (7.13 c)
---	--------------------------

<ul style="list-style-type: none"> <li>• is able to function in professional situations where scientific knowledge and skills in computer science are required;</li> <li>• has developed a critical, scientific attitude and is aware of the societal aspects and historical context of information technology;</li> <li>• is able to communicate with others at a professional level and can give clear oral and written presentations of the results of his/her work;</li> <li>• is thoroughly prepared for further education at doctorate level or for further postgraduate education as a professional computer scientist.</li> </ul>	
<p>2. Beyond the general requirements of a Computer Science Master, the graduate of Big Data Engineering is expected to have acquired knowledge, competences, and insight on</p> <ul style="list-style-type: none"> <li>• BDE-1. Architecture and scalability of data processing platforms and their programming models.</li> <li>• BDE-2. The world wide web as a global information source.</li> <li>• BDE-3. Conducting experiments on data processing systems, and be able to properly interpret data that result from such experiments.</li> </ul> <p>Beyond the general requirements of a Computer Science Master, the graduate of Computer Systems Security is expected to have acquired knowledge, competences, and insight on:</p> <ul style="list-style-type: none"> <li>• CSS-1. Security issues in system-level software including weaknesses and defenses</li> <li>• CSS-2. Static and dynamic analysis techniques for software (benign and malicious)</li> <li>• CSS-3. Security implications of modern hardware features (side channels, hardware bugs, and hardware-based protection)</li> </ul> <p>Beyond the general requirements of a Computer Science Master, the graduate of Foundations of Computing and Concurrency is expected to have acquired knowledge, competences, and insight on:</p> <ul style="list-style-type: none"> <li>• FCC-1. Models of computation</li> <li>• FCC-2. Models of concurrency</li> <li>• FCC-3. Automated verification</li> </ul> <p>Beyond the general requirements of a Computer Science Master, the graduate of Internet and Web Technology is expected to have acquired knowledge, competences, and insight on:</p> <ul style="list-style-type: none"> <li>• IWT-1. Distributed computer systems, notably in the form of capabilities for designing networked systems and with emphasis on efficient information processing on the Internet</li> <li>• IWT-2. Programming large and complex pieces of (possibly low-level) systems-oriented software</li> <li>• IWT-3. Conducting experiments on networked applications and distributed systems, and be able to properly interpret data that result from such experiments.</li> </ul> <p>Beyond the general requirements of a Computer Science Master, the graduate Parallel Computing Systems is expected to have acquired knowledge, competences, and insight on:</p> <ul style="list-style-type: none"> <li>• PCS-1. Design and architecture of parallel and distributed computing systems</li> <li>• PCS-2. Performance and efficiency of application programs and the related runtime systems and middleware services</li> </ul>	Approval OLC (7.13 b)

<ul style="list-style-type: none"> <li>PCS-3. Conducting experiments as a means for the analysis of high-performance systems, and be able to properly interpret data that result from such experiments.</li> </ul> <p>Beyond the general requirements of a Computer Science Master, the graduate of Software Engineering and Green IT is expected to have acquired knowledge, competences, and insight on:</p> <ul style="list-style-type: none"> <li>SEG-1. Reconciling conflicting software project objectives, finding acceptable compromises within limitations of cost, time, knowledge, existing systems, organisations, and societal aspects of software technology</li> <li>SEG-2. Understanding and applying current theories, models and techniques that provide a basis for decision making on IT investment issues, problem identification and analysis, software architecture, software design, development, implementation, testing, documentation and reengineering</li> <li>SEG-3. Designing and conducting experiments (and empirical studies in general) to analyse and assess the relation between software systems, energy efficiency and sustainability issues.</li> </ul>	
---	--

## 10. Curriculum structure

### Article 10.1 Composition of the programme

1. The programme comprises at least a package of compulsory components and an individual Master's thesis or academic internship.	Ordinance CvB, see appendix 3
2. Additionally the programme can offer: <ul style="list-style-type: none"> <li>- Practical exercises</li> <li>- Electives</li> </ul>	Advice OLC; (7.13 a)
3. Educational components are categorized as specialized (400), research oriented (500) and highly specialized (600) level.	Ordinance CvB, see appendix 3

### Article 10.2 Compulsory educational components

A detailed description per educational component can be found in the Study Guide.

Educational component	course code	nr of EC	level	Advice OLC; (7.13 a)
<b>Big Data Engineering</b>				
Data Mining Techniques	X_400108	6	500	
Seminar	X_405111	6	400	
Large Scale Data Engineering	X_405116	6	500	
Web Data Processing Systems	XM_40020	6	400	
Web Services and Cloud-based Systems	XMU_418110	6	400	
Information Visualization	XMU_418143	6	0	
Master Project Computer Science	XM_0011	30	500	
<b>Computer Systems Security</b>				
Binary and Malware Analysis	X_405100	6	500	
Computer and Network Security	X_400127	6	400	
Hardware Security	XM_40014	6	500	
Master Project Computer Science	XM_0011	30	500	

Secure Software	XM_40019	6	500
Seminar	X_405111	6	400
<b>Foundations of Computing and Concurrency</b>			
Advanced Logic	X_405048	6	500
Distributed Algorithms	X_400211	6	500
Logical Verification	X_400115	6	500
Master Project Computer Science	XM_0011	30	500
Protocol Validation	X_400117	6	500
Seminar	X_405111	6	400
Term Rewriting Systems	XM_400121	6	400
<b>Internet and Web Technology</b>			
Distributed Algorithms	X_400211	6	500
Distributed Systems	X_400130	6	400
Internet programming	X_405082	6	400
Master Project Computer Science	XM_0011	30	500
Performance of Networked Systems	X_405105	6	400
Seminar	X_405111	6	400
Web Services and Cloud-based Systems	XMU_418110	6	400
<b>Parallel Computing Systems</b>			
Master Project Computer Science	XM_0011	30	500
Parallel Programming Practical	X_400162	6	500
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Programming Large-scale Parallel Systems	XM_40017	6	400
Programming Multi-core and Many-core Syg	XMU_40018	6	400
Seminar	X_405111	6	400
<b>Software Engineering and Green IT</b>			
Green Lab	X_418158	6	400
Master Project Computer Science	XM_0011	30	500
Seminar	X_405111	6	400
Service Oriented Design	X_405061	6	400
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400

#### Article 10.3 Elective educational components

1. The student can take one or more of the following electives without prior consent from the Examination Board:				Advice OLC; (7.13 a)
Name of educational component	course code	nr of EC	level	
<b>Big Data Engineering</b>				
<i>Constr. choice Foundations of Comp.&amp;Conc</i>				



Logical Verification	X_400115	6	500
Protocol Validation	X_400117	6	500
Distributed Algorithms	X_400211	6	500
Advanced Logic	X_405048	6	500
Term Rewriting Systems	XM_400121	6	400
<i>Constrained Choice Mathematics</i>			
Coding and Cryptography	X_405041	6	500
Experimental Design and Data Analysis	X_405078	6	400
<i>Constrained choice Software Engineering</i>			
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Service Oriented Design	X_405061	6	400
<i>Constrained Choice Programming</i>			
Hardware Security	XM_40014	6	500
Parallel Programming Practical	X_400162	6	500
Concurrency and Multithreading	X_405064	6	400
Internet programming	X_405082	6	400
Project Systems Testing	X_405124	6	400
Android Lab	XM_40011	6	400
Hardware Security	XM_40014	6	400
Individual Systems Practical	XM_405088	6	500
Programming Multi-core and Many-core Sysg	XMU_40018	6	400
<i>Societal Perspectives on CS</i>			
E-Commerce Law	R_E.commerc	6	500
ICT4D	X_405101	6	400
Entrepreneurship for AI and CS	XM_0009	6	400
History of digital cultures	XMU_418107	6	400
<i>Pre-approved Elective courses BDE</i>			
Advanced Logic	X_405048	6	500
Android Lab	XM_40011	6	400
Binary and Malware Analysis	X_405100	6	500
Business Process Analytics	X_400650	6	400
Business Process Management	X_405115	6	400
Computer and Network Security	X_400127	6	400
Concurrency and Multithreading	X_405064	6	400
Concurrency theory	XMU_0012	6	600

Data Mining Techniques	X_400108	6	500
Developing Services for the Cloud	X_405074	6	400
Distributed Algorithms	X_400211	6	500
Evolutionary Computing	X_400111	6	400
Green Lab	X_418158	6	400
Hardware Security	XM_40014	6	400
High Performance Computing and Big Data	XMU_40013	6	400
ICT4D	X_405101	6	400
Industrial Internship	XM_405080	6	400
Information Visualization	XMU_418143	6	0
Internet programming	X_405082	6	400
Introduction to Computational Science	XMU_418111	6	400
Knowledge and Media	X_405065	6	500
Knowledge Engineering	X_405099	6	400
Lambda Calculus	XMU_418108	6	0
Large Scale Data Engineering	X_405116	6	500
Logical Verification	X_400115	6	500
Machine Learning for the Quantified Self	XM_40012	6	400
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Performance of Networked Systems	X_405105	6	400
Programming Large-scale Parallel Systems	XM_40017	6	400
Programming Multi-core and Many-core Syg	XMU_40018	6	400
Protocol Validation	X_400117	6	500
Secure Software	XM_40019	6	500
Service Oriented Design	X_405061	6	400
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Term Rewriting Systems	XM_400121	6	400
The Social Web	X_405086	6	400
Watson Innovation	X_405129	6	400
Web Data Processing Systems	XM_40020	6	400
Web Services and Cloud-based Systems	XMU_418110	6	400
<b>Computer Systems Security</b>			
<i>Constr. choice Foundations of Comp.&amp;Conc</i>			
Logical Verification	X_400115	6	500
Protocol Validation	X_400117	6	500
Distributed Algorithms	X_400211	6	500

Advanced Logic	X_405048	6	500
Term Rewriting Systems	XM_400121	6	400
<i>Constrained Choice Mathematics</i>			
Coding and Cryptography	X_405041	6	500
Experimental Design and Data Analysis	X_405078	6	400
<i>Constrained choice Software Engineering</i>			
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Service Oriented Design	X_405061	6	400
<i>Societal Perspectives on CS</i>			
E-Commerce Law	R_E.commerc	6	500
ICT4D	X_405101	6	400
Entrepreneurship for AI and CS	XM_0009	6	400
History of digital cultures	XMU_418107	6	400
<i>Pre-approved Elective courses</i>			
Advanced Logic	X_405048	6	500
Android Lab	XM_40011	6	400
Binary and Malware Analysis	X_405100	6	500
Business Process Analytics	X_400650	6	400
Business Process Management	X_405115	6	400
Computer and Network Security	X_400127	6	400
Concurrency and Multithreading	X_405064	6	400
Concurrency theory	XMU_0012	6	600
Data Mining Techniques	X_400108	6	500
Developing Services for the Cloud	X_405074	6	400
Distributed Algorithms	X_400211	6	500
Evolutionary Computing	X_400111	6	400
Green Lab	X_418158	6	400
Hardware Security	XM_40014	6	400
High Performance Computing and Big Data	XMU_40013	6	400
ICT4D	X_405101	6	400
Industrial Internship	XM_405080	6	400
Information Visualization	XMU_418143	6	0
Internet programming	X_405082	6	400
Introduction to Computational Science	XMU_418111	6	400
Knowledge and Media	X_405065	6	500
Knowledge Engineering	X_405099	6	400

Lambda Calculus	XMU_418108	6	0
Large Scale Data Engineering	X_405116	6	500
Logical Verification	X_400115	6	500
Machine Learning for the Quantified Self	XM_40012	6	400
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Performance of Networked Systems	X_405105	6	400
Programming Large-scale Parallel Systems	XM_40017	6	400
Programming Multi-core and Many-core Syg	XMU_40018	6	400
Protocol Validation	X_400117	6	500
Secure Software	XM_40019	6	500
Service Oriented Design	X_405061	6	400
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Term Rewriting Systems	XM_400121	6	400
The Social Web	X_405086	6	400
Watson Innovation	X_405129	6	400
Web Data Processing Systems	XM_40020	6	400
Web Services and Cloud-based Systems	XMU_418110	6	400
<b>Foundations of Computing and Concurrency</b>			
<i>Constrained Choice Mathematics</i>			
Coding and Cryptography	X_405041	6	500
Experimental Design and Data Analysis	X_405078	6	400
<i>Constrained choice Software Engineering</i>			
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Service Oriented Design	X_405061	6	400
<i>Constrained Choice Programming</i>			
Hardware Security	XM_40014	6	500
Parallel Programming Practical	X_400162	6	500
Concurrency and Multithreading	X_405064	6	400
Internet programming	X_405082	6	400
Project Systems Testing	X_405124	6	400
Android Lab	XM_40011	6	400
Hardware Security	XM_40014	6	400

Individual Systems Practical	XM_405088	6	500
Programming Multi-core and Many-core Sys	XMU_40018	6	400
<i>Societal Perspectives on CS</i>			
E-Commerce Law	R_E.commerc	6	500
ICT4D	X_405101	6	400
Entrepreneurship for AI and CS	XM_0009	6	400
History of digital cultures	XMU_418107	6	400
<i>Pre-approved Elective courses</i>			
Advanced Logic	X_405048	6	500
Android Lab	XM_40011	6	400
Binary and Malware Analysis	X_405100	6	500
Business Process Analytics	X_400650	6	400
Business Process Management	X_405115	6	400
Computer and Network Security	X_400127	6	400
Concurrency and Multithreading	X_405064	6	400
Concurrency theory	XMU_0012	6	600
Data Mining Techniques	X_400108	6	500
Developing Services for the Cloud	X_405074	6	400
Distributed Algorithms	X_400211	6	500
Evolutionary Computing	X_400111	6	400
Green Lab	X_418158	6	400
Hardware Security	XM_40014	6	400
High Performance Computing and Big Data	XMU_40013	6	400
ICT4D	X_405101	6	400
Industrial Internship	XM_405080	6	400
Information Visualization	XMU_418143	6	0
Internet programming	X_405082	6	400
Introduction to Computational Science	XMU_418111	6	400
Knowledge and Media	X_405065	6	500
Knowledge Engineering	X_405099	6	400
Lambda Calculus	XMU_418108	6	0
Large Scale Data Engineering	X_405116	6	500
Logical Verification	X_400115	6	500
Machine Learning for the Quantified Self	XM_40012	6	400
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Performance of Networked Systems	X_405105	6	400
Programming Large-scale Parallel Systems	XM_40017	6	400

Programming Multi-core and Many-core Syg	XMU_40018	6	400
Protocol Validation	X_400117	6	500
Secure Software	XM_40019	6	500
Service Oriented Design	X_405061	6	400
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Term Rewriting Systems	XM_400121	6	400
The Social Web	X_405086	6	400
Watson Innovation	X_405129	6	400
Web Data Processing Systems	XM_40020	6	400
Web Services and Cloud-based Systems	XMU_418110	6	400
<b>Internet and Web Technology</b>			
<i>Constrained Choice Mathematics</i>			
Coding and Cryptography	X_405041	6	500
Experimental Design and Data Analysis	X_405078	6	400
<i>Constrained choice Software Engineering</i>			
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Service Oriented Design	X_405061	6	400
<i>Societal Perspectives on CS</i>			
E-Commerce Law	R_E.commerc	6	500
ICT4D	X_405101	6	400
Entrepreneurship for AI and CS	XM_0009	6	400
History of digital cultures	XMU_418107	6	400
<i>Pre-approved Elective courses</i>			
Advanced Logic	X_405048	6	500
Android Lab	XM_40011	6	400
Binary and Malware Analysis	X_405100	6	500
Business Process Analytics	X_400650	6	400
Business Process Management	X_405115	6	400
Computer and Network Security	X_400127	6	400
Concurrency and Multithreading	X_405064	6	400
Concurrency theory	XMU_0012	6	600
Data Mining Techniques	X_400108	6	500
Developing Services for the Cloud	X_405074	6	400

Distributed Algorithms	X_400211	6	500
Evolutionary Computing	X_400111	6	400
Green Lab	X_418158	6	400
Hardware Security	XM_40014	6	400
High Performance Computing and Big Data	XMU_40013	6	400
ICT4D	X_405101	6	400
Industrial Internship	XM_405080	6	400
Information Visualization	XMU_418143	6	0
Internet programming	X_405082	6	400
Introduction to Computational Science	XMU_418111	6	400
Knowledge and Media	X_405065	6	500
Knowledge Engineering	X_405099	6	400
Lambda Calculus	XMU_418108	6	0
Large Scale Data Engineering	X_405116	6	500
Logical Verification	X_400115	6	500
Machine Learning for the Quantified Self	XM_40012	6	400
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Performance of Networked Systems	X_405105	6	400
Programming Large-scale Parallel Systems	XM_40017	6	400
Programming Multi-core and Many-core Syg	XMU_40018	6	400
Protocol Validation	X_400117	6	500
Secure Software	XM_40019	6	500
Service Oriented Design	X_405061	6	400
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Term Rewriting Systems	XM_400121	6	400
The Social Web	X_405086	6	400
Watson Innovation	X_405129	6	400
Web Data Processing Systems	XM_40020	6	400
Web Services and Cloud-based Systems	XMU_418110	6	400
<b>Parallel Computing Systems</b>			
<i>Constr. choice Foundations of Comp.&amp;Conc</i>			
Logical Verification	X_400115	6	500
Protocol Validation	X_400117	6	500
Distributed Algorithms	X_400211	6	500
Advanced Logic	X_405048	6	500
Term Rewriting Systems	XM_400121	6	400

<i>Constrained Choice Mathematics</i>			
Coding and Cryptography	X_405041	6	500
Experimental Design and Data Analysis	X_405078	6	400
<i>Constrained choice Software Engineering</i>			
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Service Oriented Design	X_405061	6	400
<i>Societal Perspectives on CS</i>			
E-Commerce Law	R_E.commerc	6	500
ICT4D	X_405101	6	400
Entrepreneurship for AI and CS	XM_0009	6	400
History of digital cultures	XMU_418107	6	400
<i>Pre-approved Elective courses</i>			
Advanced Logic	X_405048	6	500
Android Lab	XM_40011	6	400
Binary and Malware Analysis	X_405100	6	500
Business Process Analytics	X_400650	6	400
Business Process Management	X_405115	6	400
Computer and Network Security	X_400127	6	400
Concurrency and Multithreading	X_405064	6	400
Concurrency theory	XMU_0012	6	600
Data Mining Techniques	X_400108	6	500
Developing Services for the Cloud	X_405074	6	400
Distributed Algorithms	X_400211	6	500
Evolutionary Computing	X_400111	6	400
Green Lab	X_418158	6	400
Hardware Security	XM_40014	6	400
High Performance Computing and Big Data	XMU_40013	6	400
ICT4D	X_405101	6	400
Industrial Internship	XM_405080	6	400
Information Visualization	XMU_418143	6	0
Internet programming	X_405082	6	400
Introduction to Computational Science	XMU_418111	6	400
Knowledge and Media	X_405065	6	500
Knowledge Engineering	X_405099	6	400
Lambda Calculus	XMU_418108	6	0



Large Scale Data Engineering	X_405116	6	500
Logical Verification	X_400115	6	500
Machine Learning for the Quantified Self	XM_40012	6	400
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Performance of Networked Systems	X_405105	6	400
Programming Large-scale Parallel Systems	XM_40017	6	400
Programming Multi-core and Many-core Syg	XMU_40018	6	400
Protocol Validation	X_400117	6	500
Secure Software	XM_40019	6	500
Service Oriented Design	X_405061	6	400
Software Architecture	X_400170	6	400
Software Asset Management	X_400412	6	400
Software Testing	X_400439	6	400
Term Rewriting Systems	XM_400121	6	400
The Social Web	X_405086	6	400
Watson Innovation	X_405129	6	400
Web Data Processing Systems	XM_40020	6	400
Web Services and Cloud-based Systems	XMU_418110	6	400
<b>Software Engineering and Green IT</b>			
<i>Constr. choice Foundations of Comp.&amp;Conc</i>			
Logical Verification	X_400115	6	500
Protocol Validation	X_400117	6	500
Distributed Algorithms	X_400211	6	500
Advanced Logic	X_405048	6	500
Term Rewriting Systems	XM_400121	6	400
<i>Constrained Choice Mathematics</i>			
Coding and Cryptography	X_405041	6	500
Experimental Design and Data Analysis	X_405078	6	400
<i>Constrained Choice Programming</i>			
Hardware Security	XM_40014	6	500
Parallel Programming Practical	X_400162	6	500
Concurrency and Multithreading	X_405064	6	400
Internet programming	X_405082	6	400
Project Systems Testing	X_405124	6	400
Android Lab	XM_40011	6	400
Hardware Security	XM_40014	6	400

Individual Systems Practical	XM_405088	6	500
Programming Multi-core and Many-core Syg	XMU_40018	6	400
<i>Societal Perspectives on CS</i>			
E-Commerce Law	R_E.commerc	6	500
ICT4D	X_405101	6	400
Entrepreneurship for AI and CS	XM_0009	6	400
History of digital cultures	XMU_418107	6	400
Advanced Logic	X_405048	6	500
Android Lab	XM_40011	6	400
Binary and Malware Analysis	X_405100	6	500
Business Process Analytics	X_400650	6	400
Business Process Management	X_405115	6	400
Computer and Network Security	X_400127	6	400
Concurrency and Multithreading	X_405064	6	400
Concurrency theory	XMU_0012	6	600
Data Mining Techniques	X_400108	6	500
Developing Services for the Cloud	X_405074	6	400
Distributed Algorithms	X_400211	6	500
Evolutionary Computing	X_400111	6	400
Green Lab	X_418158	6	400
Hardware Security	XM_40014	6	400
High Performance Computing and Big Data	XMU_40013	6	400
ICT4D	X_405101	6	400
Industrial Internship	XM_405080	6	400
Information Visualization	XMU_418143	6	0
Internet programming	X_405082	6	400
Introduction to Computational Science	XMU_418111	6	400
Knowledge and Media	X_405065	6	500
Knowledge Engineering	X_405099	6	400
Lambda Calculus	XMU_418108	6	0
Large Scale Data Engineering	X_405116	6	500
Logical Verification	X_400115	6	500
Machine Learning for the Quantified Self	XM_40012	6	400
Parallel System Architectures	XMU_40015	6	400
Performance Engineering	XMU_40016	6	500
Performance of Networked Systems	X_405105	6	400
Programming Large-scale Parallel Systems	XM_40017	6	400
Programming Multi-core and Many-core Syg	XMU_40018	6	400

Protocol Validation	X_400117	6	500	
Secure Software	XM_40019	6	500	
Service Oriented Design	X_405061	6	400	
Software Architecture	X_400170	6	400	
Software Asset Management	X_400412	6	400	
Software Testing	X_400439	6	400	
Term Rewriting Systems	XM_400121	6	400	
The Social Web	X_405086	6	400	
Watson Innovation	X_405129	6	400	
Web Data Processing Systems	XM_40020	6	400	
Web Services and Cloud-based Systems	XMU_418110	6	400	
2. If the student wishes to take a different educational component than listed, advance permission must be obtained in writing from the Examinations Board.				Advice OLC; (7.13 a)

#### Article 10.4 Participation in practical exercise

<p>Student are expected to participate actively in all degree components for which they are registered.</p> <p>2. In addition to the general requirement regarding active participation, the study guide details additional requirements for each degree component, including attendance requirements.</p> <p>3. At the start of each degree component, a specification will be made available which details:</p> <ul style="list-style-type: none"> <li>- The final attainment levels of the degree component;</li> <li>- The study guidelines for passing the degree component;</li> <li>- The way in which the final attainment levels are assessed;</li> <li>- The regulations for examinations and resits;</li> <li>- The guidance provided by lecturers during scheduled hours and otherwise;</li> <li>- Component attendance requirements;</li> <li>- -The provision of feedback to the student on assignments and reports submitted, and presentations given during the degree component.</li> </ul> <p>4. If a student is prevented by force majeure from attending a required degree component, then the student must send written notification of his or her absence to the examiner and the study advisor as soon as possible. The examiner may, after consultation with the study advisor, give the student an alternative assignment.</p> <p>5. Absence from degree components with required attendance is only allowed in the case of force majeure.</p> <p>6. In the event of inadequate participation, either qualitative or quantitative, the examiner may exclude the student from further participation in the degree component or a part of the degree component. The details of the student's inadequate participation must be recorded in advance and approved by the Director of Studies.</p>	Approval OLC (7.13 d)
---	--------------------------

## 11. Evaluation and transitional provisions

#### Article 11.1 Evaluation of the education

1. The education provided in this programme is evaluated in accordance with the (attached) evaluation plan. The faculty evaluation plan offers the framework.	Approval OLC (7.13 a1)
---	---------------------------

**Article 11.2 Transitional provisions**

By way of departure from the Teaching and Examination Regulations currently in force, the following transitional provisions apply for students who started the programme under a previous set of Teaching and Examination Regulations:	Advice OLC (7.13 a)
--	------------------------

Advice and approval by the Programme Committee, on (date) February 12<sup>th</sup> 2018

Approved by the Faculty Joint Assembly, on (date) June 26<sup>th</sup> 2018

Adopted by the board of the Faculty of Science on June 26<sup>th</sup> 2018

## Appendix I

### Overview of articles that must be included in the OER

Based on Section 7.13, paragraph 2, of the WHW and other Sections of the Act.

#### Section A: Faculty section

<b>2. Study programme structure</b>	
Article 2.1 Structure of academic year and educational components	7.13 paragraph 2 sub e
<b>3. Assessment and Examination</b>	
Article 3.2 Type of examination	7.13 paragraph 2 sub h, l, j
Article 3.3 Oral interim examinations	7.13 paragraph 2 sub l, n
Article 3.4 Determining and announcing results	7.13 paragraph 2 sub o
Article 3.5 Examination opportunities	7.13 paragraph 2 sub h, j
Article 3.7 Exemption	7.13 paragraph 2 sub r
Article 3.8 Validity period for results	7.13 paragraph 2 sub k
Article 3.9 Right of inspection and post-examination discussion	7.13 paragraph 2 sub p, q
<b>4. Academic student counselling and study progress</b>	
Article 4.1 Administration of study progress and academic student counselling	7.13 paragraph 2 sub u
Article 4.2 Adaptations for students with a disability	7.13 paragraph 2 sub m

#### Section B1: Programme specific – general provisions

<b>6. General programme information and characteristics</b>	
Article 6.1 Study programme information	7.13 paragraph 2 sub i, r
Article 6.2 Teaching formats used and modes of assessment	7.13 paragraph 2 sub l, x
[option:] Article 6.3 Academic student counselling	7.13 paragraph 2 sub u
<b>7. Further admission requirements</b>	
Article 7.2 Admission requirements	7.30b paragraph 2
<b>8. Interim examinations and results</b>	
Article 8.1 Sequence of interim examinations	7.13 paragraph 2 sub h, s, t
[option 1:] Article 8.2 Validity period for results	7.13 paragraph 2 sub k
[option 2:] Article 8.2 Validity period for results	7.13 paragraph 2 sub k

#### Section B2: Programme specific – content of programme

<b>9. Programme objectives, specializations and exit qualifications</b>	
Article 9.1 Workload	7.13 paragraph 2 sub g
Article 9.2 Specializations	7.13 paragraph 2 sub a
Article 9.3 Programme objective	7.13 paragraph 2 sub a
Article 9.4 Exit qualifications	7.13 paragraph 2 sub b, c
<b>10. Curriculum structure</b>	
Article 10.1 Composition of the programme	7.13 paragraph 2 sub a
Article 10.2 Compulsory educational components	7.13 paragraph 2 sub a
[Optional] Article 10.3 Elective educational components	7.13 paragraph 2 sub a
[Optional] Article 10.4 Practical exercise	7.13 paragraph 2 sub d
Article 10.5 Participation in practical exercise	7.13 paragraph 2 sub d
<b>11. Evaluation and transitional provisions</b>	
Article 11.1 Evaluation of the education	7.13 paragraph 2 sub a1
Article 11.2 Transitional provisions	7.13 paragraph 2 sub a

**Appendix II**

Table of right of advice and right of approval by the OLC and FGV

*(translation to English at a later stage)*

<b>Onderwerpen Onderwijs – en Examenregeling (OER) 7.13</b> <b>paragraaf 2 WHW</b>	<b>FGV</b>		<b>OplC</b>	
	<b>I</b>	<b>A</b>	<b>I</b>	<b>A</b>
a. de inhoud van de opleiding en van de daaraan verbonden examens				
a1. de wijze waarop het onderwijs in de desbetreffende opleiding wordt geëvalueerd				
b. de inhoud van de afstudeerrichtingen binnen een opleiding				
c. de kwaliteiten op het gebied van kennis, inzicht en vaardigheden die een student zich bij beëindiging van de opleiding moet hebben verworven				
d. waar nodig, de inrichting van praktische oefeningen				
e. de studielast van de opleiding en van elk van de daarvan deel uitmakende onderwijseenheden				
f. de nadere regels, bedoeld in de Articleen 7.8b, zesde paragraaf, en 7.9, vijfde paragraaf (BSA)				
g. ten aanzien van welke masteropleidingen toepassing is gegeven aan Article 7.4a, achtste paragraaf ( <i>verhoogde studielast</i> )				
h. het aantal en de volgtijdelijkheid van de tentamens alsmede de momenten waarop deze afgelegd kunnen worden				
i. de voltijdse, deeltijdse of duale inrichting van de opleiding				
j. waar nodig, de volgorde waarin, de tijdvakken waarbinnen en het aantal malen per studiejaar dat de gelegenheid wordt geboden tot het afleggen van de tentamens en examens				
k. waar nodig, de geldigheidsduur van met goed gevolg afgelegde tentamens, behoudens de bevoegdheid van de examencommissie die geldigheidsduur te verlengen				
l. of de tentamens mondeling, schriftelijk of op een andere wijze worden afgelegd, behoudens de bevoegdheid van de examencommissie in bijzondere gevallen anders te bepalen				
m. de wijze waarop studenten met een handicap of chronische ziekte redelijkerwijs in de gelegenheid worden gesteld de tentamens af te leggen				
n. de openbaarheid van mondeling af te nemen tentamens, behoudens de bevoegdheid van de examencommissie in bijzondere gevallen anders te bepalen				
o. de termijn waarbinnen de uitslag van een tentamen bekend wordt gemaakt alsmede of en op welke wijze van deze termijn kan worden afgeweken				
p. de wijze waarop en de termijn gedurende welke degene die een schriftelijk tentamen heeft afgelegd, inzage verkrijgt in zijn beoordeelde werk				
q. de wijze waarop en de termijn gedurende welke kennis genomen kan worden van vragen en opdrachten, gesteld of gegeven in het kader van een schriftelijk afgenomen tentamen en van de normen aan de hand waarvan de beoordeling heeft plaatsgevonden				
r. de gronden waarop de examencommissie voor eerder met goed gevolg afgelegde tentamens of examens in het hoger onderwijs, dan wel voor buiten het hoger onderwijs opgedane kennis of vaardigheden, vrijstelling kan verlenen van het afleggen van een of meer tentamens				
s. waar nodig, dat het met goed gevolg afgelegd hebben van tentamens voorwaarde is voor de toelating tot het afleggen van andere tentamens				
t. waar nodig, de verplichting tot het deelnemen aan praktische oefeningen met het oog op de toelating tot het afleggen van het desbetreffende tentamen, behoudens de bevoegdheid van de examencommissie vrijstelling van die verplichting te verlenen, al dan niet onder oplegging van vervangende eisen				
u. de bewaking van studievoortgang en de individuele studiebegeleiding				
v. indien van toepassing: de wijze waarop de selectie van studenten voor een speciaal traject binnen een opleiding, bedoeld in Article 7.9b, plaatsvindt ( <i>excellentietraject binnen een opleiding</i> )				
x. de feitelijke vormgeving van het onderwijs				
<i>alle overige onderwerpen die in de OER zijn geregeld maar die niet als zodanig zijn genoemd in art. 7.13 WHW onder a t/m x.</i>				

*De lettering komt overeen met de lettering van Article 7.13 paragraaf 2 WHW*

**Appendix III**

## Ordinances VU CvB and Binding Guidelines (richtlijn)

<b>Section A, article:</b>	<b>Concerns:</b>	<b>CvB ordinance / guideline</b>
2.1.1, 2.1.2	Year planning two semesters 8-8-4 (uniforme jaarkalender VU-UvA)	29-9-2008 (period 2009-2015) 22-05-2014 (periode 2016-2025)
2.1.3, 2.1.4	Educational components	Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017
3.1	Compulsory signing up	CvB ordinance 30-09-2010, prior consent USR.
3.4.1	Determination and publication of the results (1) Grading deadline exams 10 workdays (2) Theses 20 workdays	(1) Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017 (2) Quality demand 11 from the VU assessment policy, CvB ordinance 15-05-2012
3.5.1	Two possibilities to take examinations per year	Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017
3.5.2	Retake: most recent grade is valid. A pass can be retaken	Taken from the UvA guidelines, as part of the harmonization, CvB ordinance 24-02-2014
3.5.4	Extra retake last year	Included in (prior) model OER 16-17 following a request from committee O&O and adopted by CvB op 27-10-2015
3.6	Grades	CvB ordinance 30-09-2010, with University council's consent. As a result of harmonization UvA, the guideline: 5.5 is a pass, has been added. CvB ordinance 24-02-2014.
<b>Section B1, article:</b>	<b>Concerns:</b>	<b>CvB ordinance / guideline</b>
7.2.1	Admission criteria; at least WO Bachelor's degree	Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017
7.2.3	Additional admission criteria; type of criteria	Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017
<b>Section B1, article:</b>	<b>Concerns:</b>	<b>CvB ordinance / guideline</b>
10.1	Composition programme	Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017
10.2	Categorization of components	Richtlijn Bachelor en Masteronderwijs, revised on 6 June 2017