Appendices for the Bachelor's degree programme in Computing Science 2018-2019

Appendix I Learning outcomes of the degree programme (article 1.3.a)

Holders of a Bachelor's degree in Computing Science:

1. Have the following knowledge, understanding and insights on an academic level:
   a. knowledge of the main topics of Computing Science;
   b. understanding of common themes and principles of Computing Science on different levels of abstraction;
   c. insight in the applicability of Computing Science and the interplay between theory and practice;
   d. either d1: in-depth knowledge of certain topics in the field of Computing Science,
       or d2: broad-based knowledge of topics in a different discipline.

2. Have the following skills and competences, on an academic level:
   a. technical skills associated with Computing Science, including relevant mathematical and logical skills;
   b. relevant soft skills, including communication, intercultural teamwork and self-managed learning;
   c. academic skills, including conceptual thinking, critical questioning, judgement forming, scientific research, writing and presenting in English;
   d. the competence to analyse, structure, redefine and solve problems, using computational methods and tools;
   e. the competence to design, develop and evaluate computer systems;
   f. the competence to apply their knowledge and understanding of Computing Science in a globalized professional and entrepreneurial context.

3. Have the following attitudes:
   a. appreciation of the role and importance of mathematics, related disciplines and domain-specific knowledge;
   b. commitment to professional responsibility, including ethical, societal and intercultural issues, with a self-critical attitude;
   c. critical and academic attitude towards information and knowledge;
   d. preparedness to life-long learning, based on the awareness of the highly dynamical character of Computing Science.

Appendix II Majors and Minors of the degree programme (article 2.1.4)

The degree programme has one Major: Computing Science.

Appendix III Course units in the propaedeutic phase

- **List of course units; article 3.1.1**

Course unit name	ECTS	Type of examination	Practical
Imperative Programming	5	p,e	x
Introduction to Computing Science	5	p,e	x
Introduction to Logic (CS & MA)	5	p,e	x
Discrete Structures	5	p,e	
Computer Architecture	5	p,e	x
Calculus for Computing Science	5	p,e	x
Algorithms and Data Structures in C	5	p,e	x
Introduction to Information Systems	5	p,e	x
Program Correctness	5	p,e	
Artificial Intelligence 1	5	p,e	x
Object-Oriented Programming	5	p,e	x
Linear Algebra & Multivariable Calculus for AI&CS	5	p,e	
Total	**60**		

(p=practical and/or homework, e=examination, x=computer practical)

Appendix IV Course units in the post-propaedeutic phase

- **List of course units; article 6.1.1**

Course unit	ECTS	Type of examination	Practical
Functional Programming	5	p,e	x
Advanced Object Oriented Programming	5	p	x
Statistics (AI and CS)	5	p,e	x
Problem Analysis and Software Design	5	p	x
Advanced Algorithms and Data Structures	5	p,e	x
Signals and Systems	5	p,e	x
Introduction to Scientific Computing	5	p,e	x
Software Engineering	10	p	x
Computing Science: Ethical and Professional Issues	5	p,e	x
Parallel Computing	5	p,e	x
Languages and Machines	5	p,e	
Minor (content determined by the student) *Optional course units offered by Computing Science that may be used to fill (part of) the minor:* - *Requirements Engineering and Software Startups* - *Information Security* - *Introduction to Intelligent Systems* - *Software Quality Assurance and Testing* - *Software Language Engineering* - *Short programming project*	30 *5* *5* *5* *5* *5* *5*	 *p,e* *p,e* *p,e* *p* *p,e* *p*	 *x* *x* *x* *x* *x* *x*
Web Engineering	5	p,e	
Computer Graphics	5	p,e	x
Operating Systems	5	p,e	x
Bachelor's project	15	thesis and colloquium	variable
Total	**120**		

(p=practical and/or homework, e=examination, x=computer practical)

- **Compulsory order of examinations; article 8.2**

The examinations for the course units listed below may not be taken before the examinations for the associated course units have been passed:

- Signals and Systems after having passed Calculus for Computing Science and Linear Algebra & Multivariable Calculus for AI&CS.
- Bachelor's project after having completed the propaedeutic phase and earned 80 ECTS from years 2 and 3.

Appendix V Entry requirements (article 10.2.1)

A. Deficient VWO-diploma

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act: Mathematics B at VWO (pre-university) level.

2. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

B. HBO (university of applied science) propaedeutic certificate, other universities

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act: Mathematics B at VWO (pre-university) level.

2. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

3. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

C. Foreign qualifications (EEA)

1. Any certificate that grants access to a university in a European country will also grant access to Dutch universities.

2. In the entrance examination, as referred to in art. 7.28, paragraph 3 of the Act, per country and educational institution specific training conditions are mentioned. These are standardized. The entrance examination is, in accordance with the Admissions Board Bachelor's programmes FSE, carried out by the Admissions Office. If for a specific diploma no standardisation has taken place then the requirements as formulated for candidates with a HBO (university of applied science) propaedeutic certificate will apply to these candidates in the entrance examination as defined in Article 7.28.3 of the Act (see A).

3. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

4. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

D. Foreign qualifications (non-EEA)

1. A non-European certificate that according to NUFFIC and/or NARIC standards is equivalent to a Dutch VWO certificate will grant access to university in the Netherlands.

2. In the entrance examination, as referred to in art. 7.28, paragraph 3 of the Act, per country and educational institution specific training conditions are mentioned. These are standardized. The entrance examination is, in accordance with the Admissions Board Bachelor's programmes FSE, carried out by the Admissions Office. If for a specific diploma no standardisation has taken place then the requirements as formulated for candidates with a HBO (university of applied science) propaedeutic certificate will apply to these candidates in the entrance examination as defined in Article 7.28.3 of the Act (see A).

3. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

4. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

D. Foreign qualifications (International Baccalaureate)

1. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act: Maths Higher Level.

2. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

E. Entrance examination (Colloquium Doctum)

1. The following requirements apply to the entrance examination as defined in Article 7.29 of the Act:
   - Nature and Health at VWO level: English, Mathematics B, Chemistry, Biology
   - Nature and Technology at VWO level: English, Mathematics B, Physics, Chemistry

2. In addition, candidates are required to be competent in English:

IELTS (Academic)	6.5 - no less than 6.0 on each section
TOEFL IBT (internet-based test)	92 - no less than 21 on each section
TOEFL CBT (computer-based test)	237 - no less than 21 on each section
TOEFL PBT (paper-based test)	580 - no less than 55 on each section
Cambridge English	CAE or CPE Certificate
English language test - University of Groningen Language Centre	Minimum section scores C2 or C1 (one B2 allowed)

3. The Admissions Board Bachelor's programmes FSE will determine whether deficiencies have been compensated satisfactorily.

Appendix VII Admission to the post-propaedeutic phase (article 5.1.1)

The following candidates will be admitted to the post-propaedeutic phase:
Students who have been issued a positive study advice from the degree programme in Computing Science

Appendix VIII Contact hours propaedeutic phase (article 2.4)

Bachelor year 1	
Type of contact	*Number of contact hours per year*
Lectures	280
Tutorials	216
Practical	112
Study support/Mentor groups	–
Internship support and guidance	–
Exams	43
Misc. contact hours	–

Appendix IX University Minors of the faculty of Science and Engineering (article 7.5.1)

1. Neurosciences Minor (taught in English):
    - Neuroscience (15 ECTS)
    - Behavioural Neuroscience (15 ECTS)

    People, Planet, Profit Minor (taught in English):
    - Overview and Coherence People Planet Profit (10 ECTS)
    - Paper People Planet Profit (5 ECTS)
    - Project People, Planet, Profit (15 ECTS)

    Astronomy through Space and Time Minor (taught in English):
    - The Evolving Universe (5 ECTS)
    - Cosmic Origins (5 ECTS)
    - Astrobiology (5 ECTS)

    Einstein's physics: Space-time and parallel worlds (taught in English):
    - Einstein's Universe (5 ECTS)
    - Quantum World (5 ECTS)
    - Building blocks of matter (5 ECTS)

2. The Programme Committee for the Bachelor's degree programmes in Biology and Life Science & Technology also has authority in the field of the Minor "Neurosciences" and/or its course units.

    The Programme Committee for the Master's degree programme in Energy & Environmental Sciences also has authority in the field of the Minor "People, Planet, Profit" and/or its course units.

    The Programme Committee for the Bachelor's degree programme in Astronomy also has authority in the field of the Minor "Astronomy through Space and Time" and/or its course units.

    The Programme Committee for the Bachelor's degree programmes in Physics and Applied Physics also has authority in the field of the Minor "Einstein's physics: Space-time and parallel worlds" and/or its course units.

3. The Board of Examiners for the Bachelor's degree programmes in Biology and Life Science & Technology and the Master's degree programmes in Biology, Ecology & Evolution, Marine Biology and Molecular Biology & Biotechnology also has authority in the field of the Neurosciences Minor and/or its course units.

    The Board of Examiners for the Master's degree programme in Energy & Environmental Sciences also has authority in the field of the People, Planet, Profit Minor and/or its course units.

    The Board of Examiners for the Bachelor's degree programme in Astronomy also has authority in the field of the Astronomy through Space and Time Minor and/or its course units.

    The Board of Examiners for the Bachelor's degree programmes in Physics and Applied Physics also has authority in the field of the Physics Minor "Einstein's physics: Space-time and parallel worlds" and/or its course units.

4. These Teaching and Examination Regulations also apply in their entirety to the Minors in Neurosciences, People, Planet, Profit, Astronomy through Space and Time and Einstein's physics: Space-time and parallel worlds and/or their course units.

Appendix X Transitional arrangement (article 12.1)

Transitional arrangement for the Bachelor's programme in Computing Science:

Discontinued course units			Substitute course units				
Course unit code	*Course unit name*	*ECTS*	*Course unit code*	*Course unit name*	*ECTS*	*Note*	*Equivalent* Yes/No*
INBVB-08	Compiler Construction	5	WBCS18001	Software Language Engineering	5	Partially similar content	Yes
INBNC-08	Net-Computing	5	WBCS18002	Web Engineering	5	Partially similar content	Yes

* It is also possible to substitute equivalent course units in the other direction. This can apply to students with a large backlog who want to fall under the new TER.