Appendix: Bachelor’s degree programme in Computing Science 2013-2014

Appendix I Learning outcomes of the Bachelor’s degree programme (Article 1.3)

Holders of a Bachelor’s degree in Computing Science:

a. Knowledge and understanding
a1. Have knowledge and understanding of the main principles of computing science.
a2. Are able, by abstracting and modelling, to delve to the root of a problem and determine whether existing methods can be applied or if new methods must be developed.
a3. Are able to reason logically both within and outside their field of study, via both ‘why’ and ‘what if’ questions.
a4. Are familiar with the fundamental limitations to calculations.
a5. (Optional Minor) Have in-depth knowledge of topics in the field of computing science or broad-based knowledge of topics in a different discipline.

b. Applying knowledge and understanding
b1. Are able to apply their knowledge of the main principles of computing science.
b2. Have experience with effective use of the methods and tools available for resolving computing problems, such as software development methods, compilers, visualization software, case tools and domain-specific software and hardware.
b3. Are able to structure and redefine poorly structured problems, asking adequate questions.
b4. Are able to cope with the fact that many design problems tend to change in the course of the process, partly due to their own design decisions.
b5. Have the required knowledge and skills to use, justify and evaluate research and design models (in the broadest sense of the word).

c. Forming judgements
c1. Are able to critically read specialist literature and assess its usefulness.
c2. Are able to reflect on the societal aspects of the applications of computing science and their own responsibility in this.
c3. Are able to critically assess programs.

d. Communication
d1. Are able to communicate their knowledge of the main foundations of computing science.
d2. Are able to communicate the results of learning, thinking and decision-making with colleagues as well as others.
d3. Display professional behaviour: drive, reliability, involvement, accuracy, perseverance and independence.
d4. Are able to work in teams and in a project-based approach: they have a pragmatic and responsible attitude and are able to work with limited sources, deal with risks and make compromises.
d5. Are able to adequately document research results in order to contribute to the development of knowledge both within and outside the subject field.

e. Learning skills
e1. Are able to keep abreast of developments in the field of computing science.
e2. Are able to familiarize themselves with new programming languages.
e3. Are able to learn to work with new developing environments.

Each track within the Bachelor's degree programme in Computing Science has a number of additional learning outcomes.

Holders of a Bachelor's degree in Computing Science who have followed the Biomedical Computing track:
a6. Have knowledge and understanding of Biomedical Computing.
b6. Are able to apply their knowledge of Biomedical Computing.

Holders of a Bachelor's degree in Computing Science who have followed the Business Computing track:
a7. Have knowledge and understanding of Business Computing.
b7. Are able to apply their knowledge of Business Computing.

Appendix II Follow-on Master's degree programmes (Article 1.5)

The Bachelor's degree programme will grant unconditional admission to the following Master's degree programmes at the University of Groningen:

Computing Science
Education and Communication in Mathematics and Natural Sciences (Science Communication programme)
Energy and Environmental Sciences

Appendix III Majors and Minors in the degree programme (Article 2.1.2)

The degree programme has one Major: Computing Science.

However, the programme offers a number of options, known as **tracks**. Each track comprises 30 ECTS (including 10 for the final-year project), substituting course units from the regular programme. Students who wish to follow the Biomedical Computing track must start with the Introduction to Biomedical Computing course unit. Students who wish to follow the Business Computing track must start with the Data en Processen [Data and Processes] course unit. Students may only choose one track.

Appendix IV Course units in the propaedeutic phase, regular track (Articles 3.1.1, 3.2)

Course unit name	**ECTS**	**Type of examination**	**Practical**
Imperative Programming	5	p,e	x
Introduction to Computing Science	5	p,e	x
Introduction to Artificial Intelligence and Cognitive Science	5	p,e	x
Introduction to Logic	5	p,e	x
Autonomous Systems **or** Introduction to Biomedical Computing	5 5	p,e p,e	x x
Calculus for AI and CS	5	p,e	x
Algorithms and Data Structures in C	5	p,e	x
Discrete Structures	5	p,e	
Program Correctness	5	p,e	
Computer Architecture and Networks	5	p,e	x
Object-Oriented Programming	5	p,e	x
Linear Algebra for AI and CS	5	p,e	
Total	**60**		

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

Biomedical Computing track

In the Biomedical Computing track, the course units Autonomous Systems and Computer Architecture and Networks from the regular track are substituted by:

Introduction to Biomedical Computing (instead of Autonomous Systems)	5	p,e	x
Bioinformatics (instead of Computer Architecture and Networks)	5	p,e	x

This track is continued in the post-propaedeutic phase.

Business Computing track

In the Business Computing track, the course unit Program Correctness from the regular track is substituted by:

Business Intelligence (instead of Program Correctness)	5	pt	x

This track is continued in the post-propaedeutic phase.

Appendix V Course units in the post-propaedeutic phase (Articles 6.1, 6.2, 7.4)

Course unit	ECTS	Type of examination	Practical
Advanced Algorithms and Data Structures	5	p,e	x
Functional Programming	5	p,e	x
Advanced OO Programming	5	p	x
Statistics (for AI and Computing Science)	5	p,e	x
Software Analysis and Design	5	p	x
Introduction to Information Systems	5	p,e	x
Software Engineering 1	5	p	x
Signals and Systems	5	p,e	x
IT Business Practice	5	p	
Software Engineering 2	5	p	x
Parallel Computing	5	p,e	x
Languages and Machines	5	p,e	
1. Optional Minor, or 2. Deepening Minor: 1. Software Requirements Engineering 2. Information Security 3. Introduction to Intelligent Systems 4. Knowledge Representation and Reasoning	30 30 5 5 5 5	 p,e p,e p,e p,e	 x x x x
NetComputing	5	p,e	x
Computer Graphics	5	p,e	x
Operating Systems	5	p,e	x
Compiler Construction	5	p,e	x
Final-year project	10	thesis and colloquium	variable
Total	**120**		

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

Biomedical Computing track

In the Biomedical Computing track, a number of course units from the regular track are substituted (see table below):

Imaging Techniques (instead of Languages and Machines or Parallel Computing)	5	p,e	x
Neurobiology (instead of Software Requirements Engineering or Information Security or Introduction to Intelligent Systems)	5	t	x
Bachelor's project in Advanced Biomedical Computing (instead of Final-year project)	10	thesis and colloquium	Variable

Business Computing track

In the Business Computing track, a number of course units from the regular track are substituted (see table below):

Marketing Bedrijfskunde [Business Marketing] (instead of Functional Programming)	5	t	
Management of Product Innovation (instead of Languages and Machines)	5	p,e	x
Organization and Management of Software Project Teams (instead of a Minor course unit from the same period)	5	p,e	x
Bachelor’s project in Business Computing (instead of Final-year project)	10	thesis and colloquium	variable

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 and Linear Algebra.
Bachelor’s project after having gained the propaedeutic certificate and earned 60 ECTS from years 2 and 3.