Appendices Bachelor's degree programme Artificial Intelligence
2014-2015

Appendix I Learning outcomes of the Bachelor's degree programme in Artificial Intelligence (Article 1.3)

The bachelor demonstrates knowledge, understanding, and the ability to evaluate, analyze and interpret relevant data in the field of

1. the symbolic approach to Artificial Intelligence and has the ability to apply this.
2. the numerical, non-symbolic approach to Artificial Intelligence and has the ability to apply this.
3. computational models of cognitive processes and has expertise in constructing and applying this.
4. autonomous systems and robotics and has the ability to apply this.
5. linguistics and language- and speech technology and has the ability to apply this.
6. knowledge and agent systems and has expertise in designing, implementing and applying these.

The bachelor has knowledge and understanding of

7. the most important philosophical theories developed in the areas of artificial intelligence and cognition.
8. relevant theories developed in the area of empirical sciences, psychology, biology and physics and has experience applying and analyzing results thereof.

The bachelor has relevant knowledge and ability

9. to apply methods and techniques from mathematics and logic used in Artificial Intelligence.
10. to use algorithms, data structures and important programming languages used in Artificial Intelligence.

The bachelor has the ability

11. on an academic level, to analyze problems, critically review scientific results and communicate about this both individually as well as in a group, both oral and in written form, also in a broader societal context.
12. to critically reflect on one's own working method and to recognize the need for continued learning on a high degree of autonomy, also in the context of a master or a specialist profession.

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

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

- Artificial Intelligence
- Human-Machine Communication
- Education and Communication in Mathematics and Natural Sciences (Science Communication programme) – this programme is taught in Dutch

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

The degree programme has the following **Major**:

- Artificial Intelligence

Appendix IV Course units in the propaedeutic phase

The propaedeutic phase comprises a number of course units, each with a student workload of 5 ECTS, listed in the table below (Article 3.1.1).

The table states which course units include practicals in addition to lectures, and whether the practical in question (including reporting) is part of the examination (Article 3.2).

Course unit name	**Practical**
Algorithms and Data Structures in C	yes
Artificial Intelligence I	yes
Autonomous Systems	yes
Basic Scientific Skills	yes
Calculus (for AI)	
Cognitive Psychology	yes
General Linguistics	
Human Factors	
Imperative Programming	yes
Introduction to Artificial Intelligence	
Introduction to Logic (for AI and Philosophy)	yes
Linear Algebra & Multivariable Calculus	yes

Appendix V Course units in the post-propaedeutic phase

The post-propaedeutic phase comprises the following course units with their related student workloads:

1. Course units in the **Major** (90 ECTS)
2. **Minor space** (30 ECTS)

The Major comprises the following course units (each with a student workload of 5 ECTS unless stated otherwise):

Course unit name	**Practical**
Advanced Logic	yes
Architectures of Intelligence	yes
Artificial Intelligence II	yes
Biopsychology	
Knowledge and Agent Technology	yes
Language and Speech Technology	yes
Neural Networks	yes
Neurophysics	yes
Object-Oriented Programming	yes
Philosophy of Cognitive Science	yes
Research Methods	yes
Signals and Systems	yes
Statistics (for AI and CS)	yes
Bachelor's Project (10 ECTS)	yes
Students must choose at least 15 ECTS worth of the following practicals:	
Autonomous Systems Practical (5 or 10 ECTS)	yes
Cognitive Science Practical	yes
Knowledge Technology Practical	yes
Language Technology Practical	yes
Speech Technology Practical	yes

The table states which course units include practicals in addition to lectures; the practicals (including reporting) are part of the examination (Article 6.2).

For course units without written examinations, participation in the relevant practical (including reporting) will be considered as having passed the examination.

The **Minor space** comprises the following course units:

- *At least* 15 ECTS in electives from the list below. Additional practicals, as listed under the Major course units but not followed as part of the Major programme, may also be followed.
- Supplemented by a freely chosen set of course units *to be approved by the Board of Examiners*.

Students can choose from the following list of course units without needing approval of the Board of Examiners:
(please refer to the teaching and examination regulations and curriculum assessment plans of the relevant degree programmes for modes of assessment)

- Cognition and Attention
- Cognitive Neuroscience
- Computer Graphics
- Thinking and decision making
- Functional Programming
- Informaticarecht voor niet-juristen (10 ECTS)*
- Information Security
- Introduction to Informationsystems
- Introduction Intelligent Systems
- Introduction to Scientific Computing
- Learning: Theory and practice
- Logical Programming
- Human error
- Natural Language Processing
- Parallel Computing
- Philosophy of Mind I*
- Philosophy of the Natural Sciences
- Philosophy of Science, Technology & Society
- Programming in C++ (part I, II and/or part III, together max. 8 ECTS; part I max. 2 ECTS)
- Software Analysis and Design
- Software Requirements Engineering
- Zelf-organisatie van Ecologische en Sociale Systemen*

**Taught in Dutch*

It is also possible to take a **Broadening Minor**, offered by the University of Groningen, in the Minor space *with the approval of the Board of Examiners*. Course units offered by other institutes of academic education may qualify as substitutes for the Broadening Minor *with the approval of the Board of Examiners*.

Compulsory order of examinations (Article 7.2)

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

Course unit name	Entry requirements
Advanced Logic	- Introduction to Logic (for AI and Philosophy)
Autonomous Systems Practical	- Autonomous Systems
Bachelor's Project	- At least 135 ECTS from the Bachelor's phase - Statistics (for AI and CS) - Research Methods
Cognitive Science Practical	- Cognitive Psychology - Statistics (for AI and CS)
Knowledge Technology Practical	- Knowledge and Agent Technology
Language and Speech Technology	- General Linguistics
Language Technology Practical	- Language and Speech Technology - Natural Language Processing
Natural Language Processing	- Logical Programming
Neural Networks	- Multivariable Calculus
Neurophysics	- Calculus (for AI) - Multivariable Calculus
Research Methods	- Statistics (for AI and CS)

Appendix VI Entry requirements

A. HBO (university of applied science) propaedeutic certificate

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

Degree programme	**Subjects at VWO (pre-university) level**	Requirement: Dutch as a Second Language (programme II) for non-native speakers of Dutch
B Biology	wia or wib + na+sk+bio	Yes
B Pharmacy	wia or wib + na+sk	Yes
B Life Science and Technology	wib+na+sk	Yes
B Computing Science	wib	
B Artificial Intelligence	wia or wib	
B Physics	wib+na	
B Chemistry	wib+na+sk	
B Astronomy	wib+na	
B Mathematics	wib	
B Chemical Engineering	wib+na+sk	
B Industrial Engineering and Management Science	wib	
B Applied Physics	wib+na	
B Applied Mathematics	wib	

wia = Mathematics A; wib = Mathematics B; na = Physics; sk = Chemistry; bio = Biology

2. Non-native speakers of Dutch who wish to be admitted to the Bachelor's degree programmes in Biology, Life Science and Technology, or Pharmacy must also have passed the State Examination in Dutch as a Second Language, Programme II (NT2-II).

3. The Faculty Committee for Special Admissions will determine whether deficiencies have been compensated satisfactorily.

B. Foreign qualifications (EEA)

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

2. The same requirements that also apply to candidates with an 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. Non-native speakers of Dutch who wish to be admitted to the Bachelor's degree programmes in Biology, Life Science and Technology, or Pharmacy must also have passed the State Examination in Dutch as a Second Language, Programme II (NT2-II).

4. In addition, candidates are required to be competent in English: an IELTS score of 6.5, a TOEFL score of 580 (paper-based), of 237 (computer-based) or of 92 (internet-based) or equivalent.

5. The Faculty Committee for Special Admissions will determine whether deficiencies have been compensated satisfactorily.

C. Foreign qualifications (German)

1. German candidates must have a Zeugnis der Allgemeinen Hochschulreife ('Abitur').

2. The following requirements apply to the entrance examination as defined in Article 7.28.3 of the Act:

Degree programme	
B Biology	wi (LK or GK) na (LK or GK) sk (LK or GK) bio (LK or GK) (at least one subject at Leistungskurs level)
B Pharmacy B Life Science and Technology B Chemistry B Chemical Engineering	wi (LK or GK) na (LK or GK) sk (LK or GK) (at least one subject at Leistungskurs level)
B Computing Science B Mathematics B Applied Mathematics B Artificial Intelligence	wi (LK)
B Physics B Astronomy B Applied Physics	wi (LK) na (LK or GK)
B Industrial Engineering and Management Science	wi (LK or GK) na (LK or GK) (at least one subject at Leistungskurs level)

wi= Mathematics; na = Physics; sk = Chemistry; bio = Biology
LK = Leistungskurs level; GK = Grundkurs level followed until end of Class 13 or Class 12 (if Gymnasium education lasts 12 years).

3. Non-native speakers of Dutch who wish to be admitted to the Bachelor's degree programmes in Biology, Life Science and Technology, or Pharmacy must also have passed the State Examination in Dutch as a Second Language, Programme II (NT2-II).

4. The Faculty Committee for Special Admissions 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:

Degree programme	from 2010/2011
B Biology	Biology (SL or HL) Maths (SL or HL) Physics (SL or HL) Chemistry (SL or HL) two of these subjects at HL
B Pharmacy B Life Science and Technology B Chemistry B Chemical Engineering	Maths (SL or HL) Physics (SL or HL) Chemistry (SL or HL) two of these subjects at HL
B Computing Science B Mathematics B Applied Mathematics	Maths HL
B Artificial Intelligence	Maths SL **or** Maths HL
B Physics B Astronomy B Applied Physics B Industrial Engineering and Management Science	Maths HL Physics HL

SL = Standard Level, HL = Higher Level

2. Non-native speakers of Dutch who wish to be admitted to the Bachelor's degree programmes in Biology, Life Science and Technology, or Pharmacy must also have passed the State Examination in Dutch as a Second Language, Programme II (NT2-II).

3. The Faculty Committee for Special Admissions will determine whether deficiencies have been compensated satisfactorily.

E. 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. The same requirements that also apply to candidates with an 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. Non-native speakers of Dutch who wish to be admitted to the Bachelor's degree programmes in Biology, Life Science and Technology, or Pharmacy must also have passed the State Examination in Dutch as a Second Language, Programme II (NT2-II).

4. In addition, candidates are required to be competent in English: an IELTS score of 6.5, a TOEFL score of 580 (paper-based), of 237 (computer-based) or of 92 (internet-based) or equivalent.

5. The Faculty Committee for Special Admissions will determine whether deficiencies have been compensated satisfactorily.

F. Entrance examination

1. The following requirements apply to the entrance examination as defined in Article 7.29 of the Act:

Degree programme	Nature and Health VWO level	or	Nature and Technology VWO level
B Biology	en, wia or wib, sk, bio, na		en, wib, na, sk, bio
B Pharmacy	en, wia or wib, sk, bio, na		en, wib, na, sk
B Life Science and Technology	en, wib, sk, bio, na		en, wib, na, sk
B Computing Science	en, wib, sk, bio		en, wib, na, sk
B Artificial Intelligence	en, wia of wib, sk, bio		en, wib, na, sk
B Physics	en, wib, sk, bio, na		en, wib, na, sk
B Chemistry	en, wib, sk, bio, na		en, wib, na, sk
B Astronomy	en, wib, sk, bio, na		en, wib, na, sk
B Mathematics	en, wib, sk, bio		en, wib, na, sk
B Chemical Engineering	en, wib, sk, bio, na		en, wib, na, sk
B Industrial Engineering and Management Science	en, wib, sk, bio		en, wib, na, sk
B Applied Physics	en, wib, sk, bio, na		en, wib, na, sk
B Applied Mathematics	en, wib, sk, bio		en, wib, na, sk

en = English; wia = Mathematics A; wib = Mathematics B; na = Physics; sk = Chemistry; bio = Biology

2. Non-native speakers of Dutch who wish to be admitted to the Bachelor's degree programmes in Biology, Life Science and Technology, or Pharmacy must also have passed the State Examination in Dutch as a Second Language, Programme II (NT2-II).

3. The Faculty Committee for Special Admissions will determine whether deficiencies have been compensated satisfactorily.

Appendix VII Clustering of Bachelor's degree programme

Degree programme CROHO code	Name of degree programme	Clustered with CROHO code	Name of degree programme
56286	B Life Science and Technology	56860 56157 56989	B Biology B Pharmacy B Pharmaceutical Sciences
56860	B Biology	56286 56157 56989	B Life Science and Technology B Pharmacy B Pharmaceutical Sciences
56157	B Pharmacy	56860 56286 56989	B Biology B Life Science and Technology B Pharmaceutical Sciences
56989	B Pharmaceutical Sciences	56860 56286 56157	B Biology B Life Science and Technology B Pharmacy
56980	B Mathematics	56965	B Applied Mathematics
56965	B Applied Mathematics	56980	B Mathematics
50206	B Physics	56962 50205	B Applied Physics B Astronomy
56962	B Applied Physics	50206 50205	B Physics B Astronomy
50205	B Astronomy	56962 50206	B Applied Physics B Physics
56857	B Chemistry	56960	B Chemical Engineering
56960	B Chemical Engineering	56857	B Chemistry

Appendix VIII Admission to the post-propaedeutic phase

The following candidates will be admitted to the post-propaedeutic phase:

- Holders of a propaedeutic certificate of the degree programme

Appendix IX Aard contacturen Propedeutische fase

Bachelor jaar 1	
Contacttijd	**Aantal contacturen per jaar**
Hoorcolleges	323
Werkcolleges en computerpractica	228
Studiebegeleiding	4
Stagebegeleiding	0
Tentamens/examens	51
Studieloopbaanbegeleiding (in geprogrammeerd voor alle studenten)	4
Overige gestructureerde uren	0