

Assessment Plan for the Bachelor's Programme in Artificial Intelligence (2022 – 2023)

Introduction

This assessment plan is a description of the modes of assessment and review process of all the course units that are part of the mandatory Artificial Intelligence Bachelor's degree programme in the academic year 2022-2023. This document is based on the assessment policy of the Faculty of Science and Engineering, as described in the manual for quality assurance (Chapter 6: Assessment Policy, 2018-2019).

The assessment plan formally consists of the following parts:

1. the goals of the degree programme;
2. the learning outcomes of the degree programme;
3. a description of the course units as included in programme-specific attachments of the Teaching- and Examination Regulations of 2022-2023;
4. a course description per course unit (listed in Ocasys). This course description should at least contain the following elements:
 - The course goals;
 - A description of the course contents;
 - The course lecturers;
 - The mode(s) of assessment of a course unit and the way in which they contribute to the final course grade;
 - The mode(s) of instruction of a course unit
5. a detailed overview of the examiners and mode(s) of assessment per course unit. Course units in this overview are based on the curricula of each respective study year corresponding to the Teaching- and Examination Regulations of a nominal student. The relevant sections of these Teaching- and Examination Regulations and the curricula of the respective years have been approved by the programme committee of the Artificial Intelligence (BSc.) degree programme.
6. a matrix describing the relationship between the course units and the (specification of the) learning outcomes.

Parts 3 and 4 have not been included in this document. A description of the course units is, as mentioned, located in the programme-specific attachments of the Teaching- and Examination Regulations of 2022-2023. The course description per course unit is listed on Ocasys.

In addition to the required components, these assessment plans also contain a full overview of the examiners at Artificial Intelligence (BSc.).

1. Goals of the Degree Programme

The goal of the Artificial Intelligence (BSc.) programme is to deliver critical, independent and academic individuals, who can professionally function in the field of Artificial Intelligence and Cognitive Science. The field of Artificial Intelligence is interdisciplinary, as it combines, among others, Computer Science, Psychology, Linguistics, and Neuroscience. The field has developed its own themes and methods based on these other fields of science, such as Machine Learning, Agent Technology, Cognitive Modelling and Language Technology.

Undergraduates of the Artificial Intelligence programme are expected to gain a basic understanding of the (8) key areas of Artificial Intelligence, as defined in the nationwide Frame of Reference (by the KION – Kunstmatige Intelligentie Opleidingen Nederland). In addition to knowledge of these key areas, students are expected to have an advanced level of knowledge in at least one of these (8) key areas:

- Cognitive Science
- Computational Linguistics
- Context of Artificial Intelligence (History, Philosophy, Ethics)
- Intelligent Autonomous Agents and Multi-Agent Systems
- Interaction (Perception, Human-Computer Interaction, Communication)
- Knowledge Representation and Reasoning
- Machine Learning
- Problem Solving (Search, Decision Making, Optimization)

In addition to these key areas, students must acquaint themselves with a multitude of skills, that included but are not limited to programming, general academic skills (e.g. presenting, argumentation, writing a paper), working in a team, mathematics (discrete, statistics and probability theory, linear algebra, calculus), formal logic, etc. These skills are outlined more specifically in the KION frame of reference.

Students are also expected to have knowledge of several side-modules that are connected to Artificial Intelligence. These include Architectures of Cognition, Evolutionary Algorithms and Speech Technology, among others. A more complete, but still non-exhaustive list can be found in the KION frame of reference.

The Artificial Intelligence Bachelor's programme covers all of the basic areas and skills, and covers most of the side-modules that are (directly) connected to Artificial Intelligence. Since the field covers a broad selection of topics, we attract a very diverse group of students. Despite this diverse group of students, there are some common denominators in the group of AI undergraduates (in addition to the aforementioned knowledge of key areas): students are critical, not afraid to ask questions, open, analytical and interdisciplinary. Students should be able to develop their interests and, thus, are not expected to master all of the connected areas and skills at the end of their degree programme: there is room for students to build their own profile through the choice of a set of practical course units and electives.

This view on education and these key areas are implemented throughout the courses offered in the programme. The Artificial Intelligence (BSc.) courses stick to a format (lecture, practical, tutorial, seminar, etc.) that best fits the courses in question. These courses are then assessed through varied means, once again tailored to fit the assessment that is hypothesized to be the best for the subject matter at hand. The Artificial Intelligence (BSc.) programme tends to assess courses in multiple ways, to ascertain that the final grade is not dominated by one specific mode of assessment. As such, students will have to master all the relevant skills before they can pass a course unit. The final grade directly corresponds to the student's level of mastery.

2. Learning Outcomes of the Degree Programme

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 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.

3. Overview of Examiners and Modes of Assessment per Course Unit

The Artificial Intelligence (BSc.) programme has multiple modes of assessment. Each of these has been given an abbreviation for layout purposes. An overview of these modes is listed below:

- *Assignment (AST)*
- *Interim Test (IT)*
- *Multiple Choice Exam (MC)*
- *Oral Exam (OR)*
- *Practical Work (PR)*
- *Presentation (P)*
- *Report (R)*
- *Written Exam (WE)*

The table below contains both propaedeutic and post-propaedeutic mandatory course units, as well as the courses flagged as a 'practical' course unit. Propaedeutic courses are marked in gray.

Course Unit	Course Code	ECTS	Practical	Examiners	Modes of Assessment
Course Units Organized by Own Degree Programme					
Advanced Logic	WBAIo17-05	5	No	prof. dr. L.C. Verbrugge, prof. dr. B.P. Kooi	AST, WE
Algorithms and Data Structures	WBAIo18-05	5	Yes	dr. H.A. de Weerd, <i>vacancy</i>	AST, WE
Architectures of Intelligence	WBAIo09-05	5	Yes	dr. J.P. Borst, prof. dr. N.A. Taatgen	PR, WE
Artificial Intelligence 1	WBAIo23-05	5	Yes	prof. dr. D. Grossi, <i>vacancy</i>	PR, WE
Artificial Intelligence 2	WBAIo01-05	5	Yes	prof. dr. L.R.B. Schomaker, M.A. Dhali, MSc.	PR, WE
Autonomous Systems	WBAIo02-05	5	Yes	dr. S.H. Mohades Kasaei, <i>vacancy</i>	PR, P, WE
Bachelor's Project	WBAIo901-15	15	Yes	dr. F. Cnossen, dr. S.K. Mehlhorn, project supervisors*	AST, P, R
Basic Scientific Skills	WBAIo10-05	5	Yes	dr. S.K. Mehlhorn, dr. F. Cnossen	AST, P, R
Calculus for Artificial Intelligence	WBAIo48-05	5	No	dr. ir. R. Luppés	AST, IT, WE
Cognitive Psychology	WBAIo21-05	5	Yes	dr. F. Cnossen, dr. S.K. Mehlhorn	AST, P, R, WE
Data Analytics and Communication	WBAIo11-05	5	Yes	dr. M.K. van Vugt, dr. H.A. de Weerd	PR, P, WE
Ethics in Artificial Intelligence	WBAIo40-05	5	No	dr. Z.L. Christoff, <i>vacancy</i>	AST, WE
General Linguistics	WBAIo22-05	5	No	dr. J.K. Spenader, <i>vacancy</i>	AST, WE
Imperative Programming	WBAIo03-05	5	Yes	dr. H.A. de Weerd, <i>vacancy</i>	IT, PR, WE

Introduction to Artificial Intelligence	WBAIo04-05	5	No	prof. dr. N.A. Taatgen, dr. S.K. Mehlhorn	AST
Introduction to Logic (AI)	WBAIo12-05	5	Yes	prof. dr. D. Grossi, prof. dr. L.C. Verbrugge	AST, IT, WE
Introduction to the Brain	WBAIo26-05	5	Yes	dr. M.K. van Vugt, dr. S.K. Mehlhorn	AST, MC, R
Knowledge and Agent Technology	WBAIo06-05	5	Yes	prof. dr. H.B. Verheij, prof. dr. L.C. Verbrugge	PR, WE
Language and Speech Technology	WBAIo07-05	5	Yes	dr. J.C. van Rij - Tange, <i>vacancy</i>	AST, PR, WE
Linear Algebra and Multivariable Calculus	WBAIo50-05	5	No	prof. dr. M.R. Mendez	AST, IT, WE
Neural Networks AI	WBAIo28-05	5	Yes	prof. dr. H. Jaeger, dr. S.M. van Netten	PR, WE
Object-Oriented Programming	WBAIo45-05	5	Yes	dr. H.A. de Weerd, <i>vacancy</i>	AST, PR, WE
Signals and Systems	WBAIo16-05	5	Yes	dr. H.A. de Weerd, dr. S.M. van Netten	PR, WE
Statistics	WBAIo49-05	5	Yes	dr. H.A. de Weerd, <i>vacancy</i>	AST, PR, WE
Practical Course Units					
Agent Technology Practical	WBAIo46-05	5	Yes	dr. H.A. de Weerd, <i>vacancy</i>	PR, P, R
Cognitive Ergonomics Practical	WBAIo25-05	5	Yes	dr. F. Cnossen, dr. M.B. Schippers	PR, P, R
Cognitive Modelling Practical	WBAIo20-05	5	Yes	dr. S.M. Jones, dr. M.K. van Vugt	PR, P, R
Knowledge Technology Practical	WBAIo14-05	5	Yes	prof. dr. H.B. Verheij, <i>vacancy</i>	AST, PR, P, R
Language Technology Practical	WBAIo27-05	5	Yes	dr. G. Bouma, <i>vacancy</i>	AST, R, WE
Reinforcement Learning Practical	WBAIo15-05	5	Yes	dr. M. Sabatelli, <i>vacancy</i>	AST, R
Robotics Practical 1	WBAIo30-05	5	Yes	prof. dr. R. Carloni, prof. dr. L.R.B. Schomaker	IT, PR, R
Robotics Practical 2	WBAIo29-05	5	Yes	prof. dr. R. Carloni, prof. dr. L.R.B. Schomaker	IT, PR, R
Mandatory Course Unit Organized by Other Degree Programme					
Philosophy of AI and Cognition	FI203AI	5	No	dr. M.I. Eronen	AST, WE

** The degree programme that formally owns the course provides the examiners for the course units that are organized by other degree programmes.*

The table below contains the courses that are taught by Artificial Intelligence - for Artificial Intelligence students - but are not part of the (semi-)mandatory programme. They are part of a set of pre-approved electives.

Course Unit	Course Code	ECTS	Practical	Examiners	Modes of Assessment
Introduction to Machine Learning	t.b.d.	5	t.b.d.	dr. A.I. Sburlea, dr. M.A. Valdenegro Toro	t.b.d.
Neurophysics (Physics for Artificial Intelligence)	WBAI008-05	5	Yes	dr. S.M. van Netten, prof. dr. R. Carloni	AST, PR, WE
Structural Analysis of Language for Cognitive Modelling	WBAI052-05	5	No	dr. S.M. Jones, <i>vacancy</i>	AST, WE
Uncertainty in Machine Learning	WBAI054-05	5	No	dr. M.A. Valdenegro Toro <i>vacancy</i>	AST, WE

4. Link between Course Units and Learning Outcomes

The tables in this paragraph indicate the relationship between the course units in the AI (BSc.) programme and the learning outcomes of said programme. A '1' in the table indicates an average contribution of a course unit to a specific learning outcome. A '2' indicates a strong contribution of a course unit to a specific learning outcome. Section 2 contains a full overview of the learning outcomes.

Course Unit	1	2	3	4	5	6	7	8	9	10	11	12
Course Units Organized by Own Degree Programme												
Advanced Logic	2					1			2			
Algorithms and Data Structures										2	1	
Architectures of Intelligence			2				1	2			2	
Artificial Intelligence 1	2	1				1			2	2	1	
Artificial Intelligence 2	1	2				1			2	2	1	
Autonomous Systems	1	1		2		1					1	
Bachelor's Project	*	*	*	*	*	*	*	*	*	*	2	2
Basic Scientific Skills			1					2			2	2
Calculus for Artificial Intelligence									2			
Cognitive Psychology								2			1	
Data Analytics and Communication								2	2	1	2	1
Ethics in Artificial Intelligence							2	2			2	2
General Linguistics	2				2						1	
Imperative Programming									1	2	1	
Introduction to Artificial Intelligence	2	2	1		1		1	1			1	
Introduction to the Brain			1					1			1	
Introduction to Logic (AI)	2				1				2	1		
Knowledge and Agent Technology	2		1			2	1		1	2	1	
Language and Speech Technology		2			2			1			1	
Linear Algebra & Multivariable Calculus									2			
Neural Networks AI		2	1					2	2	2	1	
Object-Oriented Programming										2	1	
Signals and Systems									2	1		
Statistics									2		2	
Practical Course Units												
Agent Technology Practical	1	1	1			2			1	2	2	1
Cognitive Ergonomics Practical			2					2		1	2	1
Cognitive Modelling Practical			2					2		1	2	1
Knowledge Technology Practical	2		1			2			1	2	2	1

Language Technology Practical	2				2				2		1	
Reinforcement Learning Practical		2						2	1		2	1
Robotics Practical 1		2		2					1	2	2	1
Robotics Practical 2		2		2					1	2	2	1
Course Units Organized by Other Degree Programmes*												
Philosophy of AI and Cognition			1					2	1		1	

** The learning outcomes in the Bachelor's Project can differ depending on the type of project.*

The table below indicates the relationships between the pre-approved elective course units in the AI (BSc.) programme and the learning outcomes. While these courses are not a formal part of the assessment of the individual courses – they are part of the assessment of the full programme, as a significant part of the diploma consists of these pre-approved electives.

Pre-approved Electives (by Own Programme)	1	2	3	4	5	6	7	8	9	10	11	12
Introduction to Machine Learning												
Neurophysics (Physics for Artificial Intelligence)		2	1					2	2	1	1	
Structural Analysis of Language for Cognitive Modelling	1				2				1			
Uncertainty in Machine Learning												
Pre-approved Electives (by Other Programmes)	1	2	3	4	5	6	7	8	9	10	11	12
Advanced Programming in C++												
C++ fundamentals												
Cognition and Attention			1				1	2				
Compiler Construction												
Computational Grammar	1				2				1	1		
Computer Graphics			1						2	1	1	
Functional Programming		1							1	2	1	
Human Error			1				1	2				
Information Retrieval												
Information Security	1	1							1	2		
Introduction to Information Systems									2	2		
Introduction to Machine Learning (CS)												
Introduction to Science Education												
IT Law for non-law students							1				1	
Logic Programming	2				1	1			2	2		
Parallel Computing	1	1							1	2		

Philosophy of the Natural Sciences							1	1			1	
Philosophy of Mind: Body, Brain, Mind			1				2	1			1	
Problem Analysis and Software Design		1								1	2	
Programming in C++	1	1								2		

5. Course Units offered to Other Degree Programmes

There is one course unit that is offered (and examined) by Artificial Intelligence, while there are no Artificial Intelligence students who take the course.

Course Unit	Course Code	Based on	ECTS	Practical	Examiners	Modes of Assessment
Introduction to Logic (MA + Guests)	WBAI013-05	Introduction to Logic (AI)	5	Yes	prof. dr. L.C. Verbrugge, prof. dr. D. Grossi	AST, IT, WE

6. Full List of Examiners

The full list of examiners consists of two parts: an overview of all the previously listed examiners, i.e. examiners that are entrusted with the responsibility of giving grades to AI (BSc.) students, and an overview of the examiners that are entrusted with the responsibility of supervising projects for AI (BSc.) students. These lists are different, since a number of courses are taught/owned by a different degree programme whose examiners do not supervise projects for the AI Bachelor's Programme.

The examiners that are involved in the organization of the course units in the mandatory Artificial Intelligence programme are:

- dr. J. van Bijsterveld
- dr. J. Borst
- prof. dr. R. Carloni
- dr. F. Cnossen
- dr. Z.L. Christoff
- M.A. Dhali, MSc.
- prof. dr. D. Grossi
- prof. dr. H. Jaeger
- dr. S.M. Jones
- dr. S.K. Mehlhorn
- dr. S.H. Mohades Kasaei
- dr. S.M. van Netten
- dr. J.C. van Rij – Tange
- dr. M. Sabatelli
- dr. A.I. Sburlea
- dr. M.B. Schippers
- prof. dr. L.R.B. Schomaker
- dr. C.L. Sibert
- dr. J.K. Spenader
- prof. dr. N.A. Taatgen
- dr. M.A. Valdenegro Toro
- prof. dr. L.C. Verbrugge
- prof. dr. H.B. Verheij
- dr. M. K. van Vugt
- dr. H.A. de Weerd
- dr. G. Bouma
- dr. M.I. Eronen
- prof. dr. B.P. Kooi
- dr. ir. R. Luppés
- prof. dr. M.R. Mendez

The following examiners are allowed to supervise Bachelor's projects in the Artificial Intelligence Bachelor's Programme*:

- dr. J. van Bijsterveld
- dr. J. Borst
- prof. dr. R. Carloni
- dr. F. Cnossen
- dr. Z.L. Christoff
- M.A. Dhali, MSc.
- prof. dr. D. Grossi
- prof. dr. H. Jaeger
- dr. S.M. Jones
- dr. S.K. Mehlhorn
- dr. S.H. Mohades Kasaei
- dr. S.M. van Netten

- dr. J.C. van Rij – Tange
- dr. M. Sabatelli
- dr. A.I. Sburlea
- dr. M.B. Schippers
- prof. dr. L.R.B. Schomaker
- dr. C.L. Sibert
- dr. J.K. Spenader
- dr. M.A. Valdenegro Toro
- prof. dr. N.A. Taatgen
- prof. dr. L.C. Verbrugge
- prof. dr. H.B. Verheij
- dr. M. K. van Vugt
- dr. H.A. de Weerd

* Other examiners require the approval of the AI BSc Board of Examiners first.