

Assessment Plan for the Master's Programme in Artificial Intelligence (2023 – 2024)

Introduction

This assessment plan is a description of the modes of assessment and review processes of all the course units that are part of the mandatory Artificial Intelligence Master's degree programme in the academic year 2023-2024. 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 2023-2024;
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. The 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 (MSc.) 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 2023-2024. 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 (MSc.) and an overview of the course units that are not part of the Artificial Intelligence (MSc.) programme but fall under their ownership nevertheless. This overview mostly includes courses that use the exact same assessment as in Artificial Intelligence (and are organized by the Artificial Intelligence base unit), but have been split into two (or more) courses purely for practical reasons.

1. Goals of the Degree Programme

The goal of the Artificial Intelligence (MSc.) programme is to deliver critical, independent and academic individuals, who can professionally function in the fields of Artificial Intelligence. Artificial Intelligence is an interdisciplinary study programme that has a strong focus on Computer Science, Formal Logic and Mathematics. The field also involves, among others, Robotics, Psychology and Linguistics. The field has developed its own themes and methods based on these other fields of science, such as Multi-agent Systems, Data Science and Machine Learning.

Graduates of the Artificial Intelligence programme are expected to have 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 advanced level knowledge in at least three and specialist level 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, Optimisation)

The AI Master's programme covers all of the basic areas and skills, and covers most of the side-modules that are (directly) connected to Artificial Intelligence and its related fields. The Artificial Intelligence master's programme generally attracts students with a very diverse background and basic knowledge in the defined key areas. There are some common denominators in the group of AI graduates: 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 pre-approved electives.

This view on education and the key areas are implemented throughout the courses offered in the programme. The AI (MSc.) 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 AI (MSc.) programme has a very strong focus on academic skills, but tends to assess courses in multiple ways, to ascertain the final grade is not dominated by a specific mode of assessment: 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.

Artificial Intelligence graduates generally have a profession as:

- An automation expert
- An (advanced) software developer- with a specialization in AI
- A data analyst/scientist for a commercial or non-commercial firm
- A consultant in the fields related to Artificial Intelligence
- A researcher in the field of Artificial Intelligence, Computational Intelligence, Computer Science, Data Science, Logic, Machine Learning, Multi-agent Systems, etc.

2. Learning Outcomes of the Degree Programme

1. The master demonstrates knowledge, understanding and the ability to evaluate, analyze and interpret relevant data, all on a level that builds on and surpasses the level of the bachelor Artificial Intelligence, in at least five of the research areas below. In one research area of Artificial Intelligence the master has specialized knowledge at a forefront level.
 - a. The symbolic approach to Artificial Intelligence
 - b. The numerical, non-symbolic approach to Artificial Intelligence
 - c. Computational theories of perception and cognition
 - d. Agent systems
 - e. Linguistics and language technology
 - f. Autonomous systems and robotics
 - g. Machine learning and pattern recognition
2. The master demonstrates knowledge and understanding, on a level that builds on and surpasses the level of the bachelor Artificial Intelligence, in the empirical sciences (Psychology, Biology and Physics) and has experience applying and analyzing results thereof.
3. The master demonstrates relevant knowledge and the ability to apply methods and techniques from mathematics and logic used in Artificial Intelligence.
4. The master demonstrates relevant knowledge and the ability to use algorithms, data structures and important programming languages used in Artificial Intelligence.
5. The master has the ability to, on an international academic level, analyze problems, critically and constructive review both one's own and other scientific results, even if incomplete, and communicate about this both individually as in a group, both oral and in written form, also in a broader societal context, for both specialists and non-specialists.
6. The master has the ability to critically reflect on one's own working method and knowledge and to recognize the need for continued learning on a high degree of autonomy, and is able to understand the scientific developments within the field of Artificial Intelligence.

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

The Artificial Intelligence (MSc.) 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 makes a distinction between courses that are included in the mandatory programme, courses that are included in any of the specializations of the programme, and pre-approved elective courses that are offered by the own programme.

Course Unit	ECTS	Practical	Examiners	Mode(s) of Assessment
Course Units in the Mandatory Programme				
Deep Learning (WMAIo17-05)	5	Yes	Dr. M.A. Valdenegro Toro, dr. M. Sabatelli	AST, WE
Design of Multi-Agent Systems (WMAIo04-05)	5	Yes	dr H.A. de Weerd, prof. dr. H.B. Verheij	PR, P, R
Final Research Project WMAIo901-45	45	Yes	Project supervisors	PR, P, R
Machine Learning (WMAIo10-05)	5	Yes	prof. dr. H. Jaeger, <i>vacancy</i>	MC, R
Methodology in Artificial Intelligence (WMAIo26-05)	5		dr. M.A. Valdenegro Toro, <i>vacancy</i>	t.b.d.
Topics in Artificial Intelligence (WMAIo25-05)	5		prof. dr. H.B. Verheij, prof. dr. L.C. Verbrugge	t.b.d.
Course Units in the Specialization(s)				
Arguing Agents (WMAIo01-05)	5	Yes	prof. dr. H.B. Verheij, prof. dr. L.C. Verbrugge	WE
Cognitive Robotics (WMAIo03-05)	5	Yes	dr. S.H. Mohades Kasaei, <i>vacancy</i>	AST, PR, R
Computational Social Choice (WMAIo16-05)	5	Yes	prof. dr. D. Grossi, dr. Z.L. Christoff	AST, R
Deep Reinforcement Learning (WMAIo24-05)	5	Yes	dr. M. Sabatelli, <i>vacancy</i>	AST, P, WE
Handwriting Recognition (WMAIo19-05)	5	Yes	M.A. Dhali, MSc. <i>vacancy</i>	PR, P, R
Logical Aspects of Multi-agent Systems (WMAIo20-05)	5	Yes	prof. dr. L.C. Verbrugge, J.D. Top, MSc.	AST, PR, P

Pattern Recognition (WMAIo21-05)	5	Yes	M.A. Dhali, MSc., <i>vacancy</i>	PR, R, WE
Robotics for AI (WMAIo11-5)	5	Yes	prof. dr. R. Carloni, <i>vacancy</i>	AST, PR, R
Elective Course Units				
Collective Intelligence (WMAIo23-05)	5	t.b.d.	dr. Z.L. Christoff, prof. dr. L.C. Verbrugge	AST, WE

4. Link between Course Units and Learning Outcomes

The tables in this paragraph indicate the relationships between the course units and the learning outcomes of the AI (MSc.) programme. For the first learning outcome, the letter denotes which specification is covered. For the other learning outcomes, '1' indicates an average contribution and '2' indicates a strong contribution of a course unit to a specific learning outcome. Section 2 contains a full overview of the learning outcomes.

Learning outcomes	1	2	3	4	5	6
Course Units in the Mandatory Programme						
Deep Learning	b, g		2	2	2	2
Design of Multi-Agent Systems	a, c, d, e		2	2	1	1
Final Research Project	*	*	*	*	2	2
Machine Learning	b, g		2	2	2	2
Methodology in AI	2	2	2	2	2	1
Topics in AI	2				2	
Course Units in the Specializations						
Arguing Agents	a, c, d, e		2	2	1	1
Cognitive Robotics	b, f, g		2	2	1	2
Computational Social Choice	a, d		2	2	2	1
Deep Reinforcement Learning	b, g		2	2	2	2
Handwriting Recognition	a, b, c, e, g		2	2	2	2
Logical Aspects of Multi-Agent Systems	a, d		2	2	2	1
Pattern Recognition	b, g		2	2		1
Robotics for AI	b, f, g		2	2	1	2
Pre-approved Electives from AI / CCS						
Applied Cognitive Engineering	c	2			2	
Cognitive Engineering	c	2			2	
Cognitive Modelling: Basic Principles and Methods	c	2		1	1	1
Cognitive Modelling: Complex Behaviour	c	2		1	2	1
Collective Intelligence	a, d		2	2	2	1
Computational Cognitive Neuroscience	c	2		1	2	
Computational Simulations of Language	e	1		1	1	
Language Modelling	e	1		1	1	
Models of Human-Syntax Processing	e	1		1	1	
Neuro-ergonomics	e	1			2	1
Non-Invasive Brain-Computer Interfaces	g	1	2	1		
User Models	c	2		1	2	1

** The learning outcomes in projects can differ depending on the type of project.*

The next table indicates the relationships between external (non-AI/CCS) pre-approved elective course units in the AI (MSc.) programme, and the learning goals. While these elective 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.

Learning outcomes	1	2	3	4	5	6
Pre-approved Electives from Other Degree Programmes						
Advanced Computer Graphics			2	1		
Advanced Topics in Security and Privacy						
Auditory and Visual Perception	c, e	1			2	
Cloud Computing and Cloud-Based Applications						
Computational Semantics	e		1	2	1	
Computer Vision	c	1	2	1		
Ethical Hacking						
Fundamentals of Distributed Systems			1	2		
Introduction Science and Business					2	
Introduction Science and Policy					2	
Introduction to Data Science	b, g		2	2		1
Language Technology Project						
Modal Logic and Proof Theory						
Natural Language Processing	e		2	1	1	
Neural Networks and Computational Intelligence	b, g		2	2		1
Neuromorphic Circuit Design						
Perception for Visual Computing						
Robotics for IEM	b, f	2	2			1
Scientific Visualization		1	2	2		
Semantic Web Technology	a, e		2	1	1	
Skills in Science Communication		1			2	
Social Network Analysis						

5. Course Units offered to Other Degree Programmes

There are no course units offered by Artificial Intelligence, which are not part of the AI programme.

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 (MSc.) students, and an overview of the examiners that are entrusted with the responsibility of supervising projects for AI (MSc.) students.

The examiners that are involved in the organization of the own course units in the Artificial Intelligence Master's Programme are:

- drs. J.O. van Bijsterveld
- dr. J. Borst
- J.D. Cardenas Cartagena, MSc.
- prof. dr. R. Carloni
- dr. Z.L. Christoff
- dr. F. Cnossen
- prof. dr. M. Cook
- R.F. Cunha, MSc.
- M.A. Dhali, MSc.
- Dr J. Dibangoye
- prof. dr. D. Grossi
- prof. dr. H. Jaeger
- dr. S.M. Jones
- I.P. de Jong, MSc
- dr. S.K. Mehlhorn
- dr. S.H. Mohades Kasaei
- dr. J.C. van Rij – Tange
- dr. M. Sabatelli
- dr. A.I. Sburlea
- dr. M.B. Schippers
- dr. C.L. Sibert
- dr. J.K. Spenader
- prof. dr. N.A. Taatgen
- dr. T.M. Tashu
- dr. S.D. Tokaç
- J.D. Top, MSc.
- dr. M.A. Valdenegro Toro
- prof. dr. L.C. Verbrugge
- prof. dr. H.B. Verheij
- dr. P.A. Vogt
- dr. M. K. van Vugt
- dr. H.A. de Weerd
- dr. B.J. Wolf
- dr. M. Zullich

The following examiners are allowed to supervise Final Year Research projects in the Artificial Intelligence Master's Programme*:

- drs. J.O. van Bijsterveld
- dr. J. Borst
- J.D. Cardenas Cartagena, MSc.
- prof. dr. R. Carloni
- dr. Z.L. Christoff
- dr. F. Cnossen
- prof. dr. M. Cook
- R.F. Cunha, MSc.
- M.A. Dhali, MSc.

- Dr J. Dibangoye
- prof. dr. D. Grossi
- prof. dr. H. Jaeger
- dr. S.M. Jones
- I.P. de Jong, MSc
- 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. T.M. Tashu
- dr. S.D. Tokaç
- J.D. Top, MSc.
- dr. M.A. Valdenegro Toro
- prof. dr. L.C. Verbrugge
- prof. dr. H.B. Verheij
- dr. P.A. Vogt
- dr. M. K. van Vugt
- dr. H.A. de Weerd
- dr. B.J. Wolf
- dr. M. Zullich

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