Assessment report
Limited Programme Assessment

Master of Logic

University of Amsterdam

Contents of the report

1. Executive summary

In this executive summary, the panel presents the main considerations with respect to the assessment of the quality of the Master of Logic programme of the University of Amsterdam, this programme having been assessed according to the Assessment Framework (22 November 2011) of NVAO (Dutch-Flemish Accreditation Organisation).

The panel has observed that the programme management has taken up the recommendations by the panel which conducted the previous review of the programme in 2007. In particular, the number of students admitted in the programme has only moderately increased, the programme management has tried to support students to obtain grants, the programme has been relocated without major problems and the programme management has been able to shield students and staff from excessive bureaucracy.

Although in a formal sense being part of the Faculty of Science, the programme may be considered to be a co-production of the Faculty of Science and the Faculty of Humanities. The panel has found that both Faculties are strongly committed to the programme.

The panel considers it a valuable objective of the programme to educate students in logic, to be understood as the general study of information, also because this gives the programme a clear profile. This concept of logic does not only establish connections to disciplines like mathematics, linguistics, computer science and philosophy, but also to disciplines like economics, game theory, cognitive science and social choice theory, thereby opening up new research directions. The programme offers four specializations, giving the students the opportunity to specialize in a specific area. The programme's intended learning outcomes are a sound representation of the objective, encompassing interdisciplinary research, advanced knowledge of the specialization which has been chosen and research and communication skills. The panel is convinced these learning outcomes meet the master's level and more than suffice to bring the students up to the required level in their specialization and in the interdisciplinary field. The research environment of the Institute for Logic, Language and Computation ensures the programme remains in line with up-to-date scientific research, in the sciences as well as in the humanities. The learning outcomes qualify for Ph.D.-positions as well as for positions in the business world.

The panel considers the entry requirements for the programme to be relevant and the admission process to be excellent. The programme management is very careful in handling requests for admission by applicants, and does not hesitate to advise them against entering the programme if there is a less than perfect match. The admission procedure is very well designed, allowing only the most talented and motivated students in.

Although the study paths of the students are individually designed and match the students' interests, the panel is convinced each one of the students attains the learning outcomes of the programme. The mentor assists them in designing a coherent curriculum, which meets the learning outcomes. Having studied the contents of the courses, the panel assesses the curriculum to be of an excellent quality, allowing the students to obtain in-depth advanced disciplinary knowledge and a broad interdisciplinary perspective on the field of logic. Scientific research is strongly represented in the courses as well as in the research projects and the thesis.

In the opinion of the panel, the lecturers are first-class researchers, being able to teach the students the state of the art of their fields of expertise. They enable the students to obtain in-depth knowledge of the various aspects of logic, at the forefront of the scientific developments. As a recommendation, the panel advises the programme management to increase the number of BKO-certified lecturers.

Although the study load of the programme corresponds to the number of credits, the panel acknowledges the programme to be very challenging. The programme management addresses the study load issue appropriately, by warning the students against overestimating their capabilities and by offering an intensive mentoring system. The study methods of the programme foster the learning processes of the students. The new University of Amsterdam schedule may not be the best schedule for some of the courses, as the learning process of some of these (e.g. certain mathematical courses) is difficult to accelerate in such a way that it fits into an eight-week period. In the opinion of the panel, the system of academic mentors of the programme is designed in an excellent manner and is very conducive to the learning processes of the students.

The panel regards the housing and the material facilities to be appropriate, especially the students' own MoL-room where they may gather for study and discussion. Also, the panel is positive about the formal and informal evaluation mechanisms the programme management has put in place.

The assessment policy of the programme is sound and conforms to the University's and Faculty's rules and regulations, taking specific aspects of the programme's examinations into account. The board of examiners acts in accordance with the rules. The panel advises the board of examiners to study, more systematically, the examinations of the courses in order to be able to assess the examinations' quality more thoroughly, to catch early warning signals wherever necessary.

The examinations of the courses meet the learning objectives of the courses and are of very good quality. The panel regards the master's thesis process and assessment to be sound and to lead to a fair assessment of the theses. Still, the panel recommends the programme management to specify the assessment criteria for the master's thesis more clearly and to communicate these more explicitly to the students.

The panel is impressed by the quality and the level of the master's theses. Having studied a representative number of these theses, the panel assesses them to have reached a level substantially above the level which may be expected of a master's thesis, and to often report results that could be included in a Ph.D.-thesis. A surprisingly large number of students are doing excellent research. The panel, also, is impressed by the large number of master's theses having led to peer-reviewed publications, often jointly written with the student's supervisor.

The program has a strong research orientation, and the majority of the graduates obtain Ph.D.-positions at renowned universities. This is another reason for the panel to assess this programme as one of the best, if not the best programme on logic in the world.

The panel has assessed the first standard of the NVAO Assessment Framework for the Master of Logic programme of the University of Amsterdam to be good and the other two standards as excellent. Therefore, the panel advises the NVAO to prolong the accreditation the Master of Logic programme of the University of Amsterdam, assessing the programme to be excellent.

Rotterdam, 2 October 2013

Chair of the assessment panel   Secretary
Prof. H.E. de Swart Ph.D.   W.J.J.C. Vercouteren MSc, RC

2. Assessment process

Certiked VBI has received a request to conduct an assessment for the accreditation of the Master of Logic programme of the University of Amsterdam.

Certiked has requested the approval by NVAO of the proposed panel of experts to conduct this assessment. NVAO have given their approval. The panel consisted of (for more detailed information please refer to Annex 4: Composition of the assessment panel):

- prof. H.E. de Swart Ph.D., panel chair, professor in French Linguistics and Semantics, Utrecht University, with a special appointment as a core member of the Cognitive Artificial Intelligence programme;
- prof. J.F. Horty Ph.D., panel member, professor, Philosophy Department and Institute for Advanced Computer Studies and affiliate professor, Computer Science Department, University of Maryland;
- prof. C. Stirling Ph.D., panel member, professor in Computer Science, School of Informatics, Edinburgh University;
- A.M.A. Kangur BSc, student member, student in the master's programme Artificial Intelligence, University of Groningen.

On behalf of Certiked, W. Vercouteren MSc, RC was responsible for the process co-ordination and for drafting the panel's report. The panel members and the secretary have signed a statement of independence and confidentiality.

The panel has conducted this assessment in accordance with the NVAO Assessment Framework (22 November 2011).

The following procedure has been adopted. The members of the panel studied the documents presented beforehand by the programme management, including a number of theses (please refer to Annex 2 and 3: Documents reviewed and Theses reviewed). As the programme is only offered in a full-time study mode, a total of 15 theses of full-time students has been selected. The theses were selected randomly in pre-specified strata of grades, to ensure a fair distribution of grades.

Prior to the site visit, every one of the panel members and the process co-ordinator/secretary discussed their preliminary findings with respect to the quality of the programme, including the quality of the theses every one of the panel members had studied. The panel members presented a number of questions to be put to the programme representatives during the site visit. On the basis of this input, the secretary drew up a complete list of questions.

On 21 June 2013, the panel conducted a site visit at the premises of the programme on the campus of the Faculty of Science of the University of Amsterdam. The site visit was conducted in accordance with the schedule drawn up beforehand (please refer to Annex 1: Schedule of site visit). The programme management communicated the open office hours to the lecturers, the students and other persons involved in the programme. The panel received one letter which was taken into account.

Immediately after the meetings of the site visit, the members of the panel shared their considerations for each of the standards of the NVAO Assessment Framework. These considerations were based on the findings during the site visit, building upon the evaluation of the documents submitted by the institution, including the theses. At the end of the site visit, the chair of the panel presented a broad outline of the findings to the programme representatives.

A draft version of this report was finalised by the secretary, taken into account the information presented as well as the findings and considerations of the panel. The draft report was, then, sent to the members of the panel. The panel members corrected and amended the draft report. Finally, the secretary drew up the final report. This report was sent to the programme management to correct for any errors. After having corrected the errors, the report was then sent to the programme management to accompany their request for re-accreditation.

3. Overview of the programme

3.1 Basic information about the programme

Administrative information about the programme:

Name programme as in CROHO: M Logic
Orientation and level programme: Academic Master
Grade: Master of Science
Number of credits: 120 EC
Specializations: Logic & Computation, Logic & Mathematics, Logic &
                                   Language, Logic & Philosophy
Location: Amsterdam
Mode of study: Full-time
Registration in CROHO: 60226

Administrative information about the institution

Name of institution: University of Amsterdam
Status of institution: Publicly funded university
Institution's quality assurance test: Positive

Quantitative data about the programme

Percentage of students who have completed the programme in three years

Cohort	2007	2008	2009
Students	59.1 %	55.2 %	72.4 %

Percentage of lecturers with the following qualifications

Qualification	Master's degree	Ph.D.	BKO
Percentage of lecturers	100 %	100 %	22 %

The student-to-staff ratio of the programme is 10.1 : 1.

The number of contact hours is 13 hours per week in the first three semesters and 2 hours per week in the final semester, when the students work on their thesis.

3.2 Main facts about the institution

The Master of Logic programme is one of the programmes of the Graduate School of Informatics of the Faculty of Science of the University of Amsterdam. The Graduate School of Informatics offers six master programmes in total, being Master in Artificial Intelligence, Master Computational Science, Master Information Studies, Master Software Engineering, Master System and Network Engineering and Master of Logic.

The Faculty of Science is one of the seven Faculties of the University of Amsterdam. The Faculties are the Faculties of Humanities, Economics and Business, Social and Behavioural Sciences, Law, Science, Medicine and Dentistry. The University of Amsterdam was founded in 1632. It is one of the largest comprehensive universities in Europe, having 35,000 students, over 5,000 staff members, a yearly number of 400 doctorates and a budget of 600 million Euros (figures of 2011/2012).

The University of Amsterdam seeks to offer an inspiring international academic environment in which both staff and students can develop their talents. Characterised by a critical, creative and international atmosphere, the University wants to maintain a tradition of open-mindedness and engagement with social issues, in keeping with the spirit of the city with which it is linked.

Within each of the Faculties, teaching and research take place in separate institutes. The University of Amsterdam strives for international prominence as a research university, aiming to maintain and strengthen the University's reputation in both fundamental and socially relevant research. The University's doctoral programmes are meant to provide a foundation for engaging in high-quality teaching and research.

3.3 Intended learning outcomes

The intended learning outcomes of the Master of Logic programme are the following..

- On the basis of the acquired knowledge, understanding and skills, graduates are able to carry out interdisciplinary research in the area of logic, language and information, either as a Ph.D. student or in an application-directed environment (IR).
- The insight (i.e. the knowledge) of graduates is based on a solid foundation in the most important aspects of logic, and its applications in computer science, linguistics, philosophy and mathematics (K1).
- The insight (i.e. the knowledge) of graduates is based on specialized knowledge at an advanced level in one or more of the following research areas: logic & computation, logic & language, logic & mathematics and logic & philosophy (K2).
- Graduates are able to formulate research questions, and address these in a research plan (S1).
- Graduates are able to make a contribution to the theories and research methods in the area of their expertise (S2).
- Graduates are able to critically evaluate contributions to their field of expertise, based on an awareness of its research traditions and conventions (S3).
- Graduates are able to collaborate with others in an multidisciplinary team (S4).
- Graduates are able to deliver and defend presentations of their own work, both orally and in writing (S5).
- Graduates possess the intellectual mobility to transcend traditional boundaries between academic disciplines that border their specialization area (IM).

3.4 Outline of the curriculum

In the table below the courses in the curriculum are presented.

General foundations	
Logic, Language and Computation	3.0 EC
Basic Logic	6.0 EC
Track-specific obligatory courses (Logic & Mathematics)	
Proof Theory	6.0 EC
Model Theory	6.0 EC
Modal Logic	6.0 EC
Axiomatic Set Theory	6.0 EC
Track-specific obligatory courses (Logic & Computation)	
Computational Complexity	6.0 EC
Recursion Theory	6.0 EC
Modal Logic	6.0 EC
Track-specific obligatory courses (Logic & Language)	
Meaning, Reference & Modality	6.0 EC
Structures for Semantics	6.0 EC
Track-specific obligatory courses (Logic & Philosophy)	
Meaning, Reference & Modality	6.0 EC
Philosophical Logic	6.0 EC
Kant, Logic & Cognition	6.0 EC
Elective courses (up to 69.0 EC)	
Non-taught components	
Research Project	6.0 EC
Thesis	30.0 EC
Research Seminars	0.0 EC
Total for programme	120.0 EC

4. Overview of the assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Good
Standard 2: Teaching-learning environment	Excellent
Standard 3: Assessment and achieved learning outcomes	Excellent
Programme as a whole	Excellent

5. Findings, considerations and assessments per standard

5.1 Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to contents, level and orientation; they meet international requirements.

Findings

The programme's objective is to create an international, interdisciplinary and research-oriented learning environment in which students are educated as researchers in the area of logic, language and computation.

In the absence of a general, validated domain-specific reference framework for logic, the programme management has drafted a reference framework to describe the concept of logic and the objectives and profile of the programme. In this framework, logic is defined as the art and science of reasoning. The origins of logic may be found in philosophy, notably regarding the structure, formalization and validity of argumentation. Subsequently, the field of logic was extended to the examination of the language in which the arguments are expressed. Logic, also, played an important role in exploring and studying the foundations of mathematics, in particular the logical derivation of theorems from axioms. Later, logic was fundamental in the creation of the new discipline of computer science. Nowadays, logic, also, plays an important part in disciplines like cognitive science and mathematical economics. So, logic has relations with many disciplines, in the sciences as well as in the humanities. Logic may be said to be the interdisciplinary study of all aspects of information, particularly language (natural languages as well as artificial ones) as carriers of information, emphasizing the use of logic and formal methods. This concept of logic is central to the programme, and its objective is to teach the students logic in this broad and interdisciplinary sense.

The programme offers four specializations or tracks, namely Logic & Computation, Logic & Language, Logic & Mathematics and Logic & Philosophy. The objectives of the programme are not only to educate the students in the field of logic in a broader sense but also to equip the students with specialized knowledge and skills about one of these tracks.

The programme management has listed the intended learning outcomes of the programme (please refer to paragraph 3.3, above for a complete list). The learning outcomes have been divided in three categories, namely (a) interdisciplinary research and intellectual mobility, (b) insight and knowledge and (c) skills. Firstly, the learning outcomes refer to the interdisciplinary nature of the programme and the intellectual mobility of the graduates, transcending boundaries of areas which border the graduate's specialization. Secondly, the programme is strongly directed towards knowledge and insight, including solid knowledge of the most important aspects of logic and its applications and advanced knowledge in the field of the graduate's specialization. Thirdly, the graduates are to master a number of skills, predominantly with respect to research and communication, like being able to contribute to the theories in their area of specialization, defend their own work and work in multidisciplinary teams.

The programme management has drafted a table comparing the intended learning outcomes to the master's level Dublin-descriptors. As may be derived from this table, the learning outcomes meet the Dublin-descriptors and, therefore, correspond to the master's level.

The programme is an academic master's programme in which the research orientation is, especially, prominent. The learning outcomes derive from the requirements of the relevant scientific disciplines (logic, mathematics, computer science, philosophy and linguistics). The graduates are taught to conduct independent scientific research in their area of specialization. The programme is being offered by the Institute for Logic, Language and Computation of the University of Amsterdam. In November 2012, the institute's research quality was assessed to be excellent. Four out of five criteria have been assessed as excellent and one out of five criteria has been assessed as very good. Although the institute is part of the Faculty of Science, many of the staff involved are from the Faculty of Humanities. The institute maintains relations with leading departments in philosophy, mathematics, linguistics and computer science and interdisciplinary centers around the world. This research environment ensures the programme's learning outcomes to be up-to-date and to reflect current developments in these disciplines.

The main objective of the programme is to educate researchers. So, academia is the primary professional field of the programme. However, the programme prepares for positions in business as well. A number of graduates have become management or technology consultants or ICT professionals. The intended learning outcomes of the programme, in terms of (interdisciplinary) knowledge and skills, may equally apply for these positions.

The programme management has compared the Master of Logic to a number of other master's programmes. In the Netherlands, there are no comparable programmes. But similar programmes are offered in Spain, England, United States, France, Germany and Hungary. The learning outcomes and curricula of these programmes are comparable, although the University of Amsterdam programme is the most comprehensive, offering four specialized tracks.

Considerations
The panel is very positive about the programme's objective. This objective is a clear and sound reflection of the concept of logic defined by the programme management . The panel considers this concept of logic as the general study of information valuable, because it gives the programme a clear profile, distinguishing it to a certain extent from similar programmes around the world. The programme benefits from this concept of logic, since it does not only establish connections to disciplines like mathematics, linguistics, computer science and philosophy but also to other disciplines like economics, game theory, cognitive science and social choice theory. The broad and interdisciplinary orientation creates possibilities for enrichment of the programme with new and innovative research directions.

In the opinion of the panel, the four specializations of the programme are a strong feature, since the programme offers the students the opportunity to specialize in a specific area of logic.

The panel regards the intended learning outcomes to be a sound representation of the objective of the programme, encompassing interdisciplinary research, advanced knowledge of the specialization which has been chosen and research and communication skills. The panel feels these learning outcomes more than suffice to bring the students up to the required level in their specialization as well as in the interdisciplinary field.

The panel considers the intended learning outcomes to meet the Dublin-descriptors and, therefore, to correspond to the master's level.

The research orientation of the programme is, in the opinion of the panel, especially strong. Embedded in the research environment of the Institute for Logic, Language and Computation, the programme benefits from relevant and up-to-date scientific research, in the sciences as well as in the humanities. Therefore, the intended learning outcomes will remain in line with current scientific research.

The panel is glad to see that the programme management is eager to ensure that the intended learning outcomes not only prepare for positions in the academic world but also for positions in consultancy and ICT. The learning outcomes of the programme qualify very well for these kinds of positions, and create new and relevant job opportunities for alumni.

In the opinion of the panel, the comparison to other, similar programmes in the world describes the general success of broad and interdisciplinary logic oriented programmes, and highlights, at the same time the special position this programme has in the world.

Assessment of this standard
These considerations have led the assessment panel to assess the standard 1 *Intended learning outcomes* as good.

5.2 Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Findings

The programme management has organized the teaching-learning environment around three focal points, namely interdisciplinarity, internationality and individuality. Interdisciplinarity means that the programme includes a range of disciplines and the students are to transcend the boundaries of their own discipline. Internationality signifies that the programme management ensures the group of students to be composed of different nationalities, thereby stimulating the exchange of views in class. Individuality means every one of the students is given the opportunity to design their own, individual curriculum and is entitled to individual guidance and supervision.

The number of students admitted to the programme was around 25 students in the years prior to 2006. Since then, this number has risen to about 30 students. As has been indicated above, the students come from many different countries. The number of Dutch students is limited to about 25 % of the total intake. About 30 % of the students are female. The programme management conducts a very strict admission procedure and wants to admit only the best students, whom they are sure can complete the programme. The programme management supplies information and guidance during the process of application, giving detailed answers to applicants' questions. To be admitted, applicants must have at least a bachelor's degree in a relevant discipline like mathematics, computer science, philosophy or linguistics, should be familiar with mathematical and formal thinking and mathematical proofs and should have a strong academic record. The applicants have to submit an application form, specifying their level of knowledge, transcripts and diplomas, a letter of motivation, letters of recommendation and proof of proficiency in the English language. Only about 30 % of the students who are interested and contact the programme management to apply for a place in the programme, are actually enrolled. Quite a number of students are actively discouraged by the programme management to apply, if they foresee a mismatch. The students who are admitted, have shown strong results in their bachelor's study. This may be derived from the average grade for the bachelor's thesis for admitted Dutch students of 8.5, compared to 8.3 for research masters and 7.8 for other master's programmes in the Netherlands.

Students who have not acquired this knowledge in their undergraduate education, are required to take one or more of the courses Basic Logic, Modal Logic or Axiomatic Set Theory, depending on the specialization they have chosen. These students have been assessed to meet the entry requirements but lack the knowledge of these courses, which are not necessarily offered at all universities. The board of examiners decides who has to take any of these courses.

Although the students choose one out of four specializations, the boundaries of these specializations are not sharply drawn. On the one hand, the specialization allows the students to gain advanced knowledge in the specialized field they have chosen. On the other hand, the students have to connect to other disciplines in order to meet the interdisciplinary learning outcomes of the programme. So, they have to take interdisciplinary courses and interact with students from other specializations. The programme management strongly recommends students to take these interdisciplinary courses. Students from different specializations help each other in bridging the gaps between disciplines. Foremost, the curriculum is characterized by a rather small number of compulsory courses, ranging from a total of 15 EC to 33 EC, depending on the specialization and the previous knowledge of the students (see preceding paragraph). The number of electives is substantial, up to a maximum of 69 EC.

Even with the large number of courses offered by the Master of Logic, it is not always possible to cater to each and everyone's area of interest. This is partly due to the need to balance the number of courses in the four tracks. Students can take courses outside of the Master of Logic electives, to further strengthen their training in specialized areas of logic. Mentors actively help students to find the right courses to suit the students' needs in other master programs in Amsterdam or at other universities. On top of the courses, the students have to complete at least one research project (6 EC), have to attend at least ten research seminars (0 EC) and have to write their master's thesis (30 EC). Quite a few students choose to complete two, three or even four research projects. The majority of the students attend more than the required number of research seminars, which constitute an important meeting point for junior researchers (Master's and PhD students) and senior staff.

The programme structure of four specializations and a large number of electives invites the students to design their individual study path. Every one of the students will, however, attain the intended learning outcomes. All of the students will take a number of basic and advanced courses, will do research, will give presentations and will write a number of papers and essays, will take interdisciplinary courses and do interdisciplinary research in the research project and in the thesis (the students are required to select two different topics) and will study for two years in an interdisciplinary research environment. The individual study paths the students choose, are designed in close collaboration with their mentor. The mentor, being a member of the staff, assists the students in outlining a path which matches the intended learning outcomes and meets the individual interests of the student.

The core staff of the programme comprises about 30 researchers from the Institute for Logic, Language and Computation. They are responsible for about 90 % of the programme. They are located in different faculties (Science and Humanities), but their embedding in an interdisciplinary research environment constitutes a solid foundation for their collaboration in the Master of Logic. The other lecturers include postdoctoral research fellows at this institute and senior scientists from other institutions. The lecturers are all renowned researchers in their field, many of whom having received prestigious NWO grants and awards. They all publish in peer-reviewed journals and some of them have written widely used textbooks. The lecturers have substantial international experience, frequently having lectured at other institutions around the world. A number of lecturers have won awards for teaching. The number of lecturers with a BKO is, however, only 22 %. The students with whom the panel has spoken, have expressed the contents of the courses to be very interesting and the lecturers to be very approachable.

The study load of the programme is 120 EC, spread over two years. The programme is very challenging programme and demands a lot of effort on the part of the students. Moreover, many students tend to take more courses and to complete more projects than required, thus increasing their study load. The programme management warns the students against overestimating their own capabilities.

The study methods of the programme are classical lectures, combined with tutorials in which the students work on exercises (mainly in case of the mathematical courses), seminar sessions (students discussing topics) and/or computer lab sessions. In the research projects the students may design and execute experiments. The schedule of the programme conforms to the guidelines of the University of Amsterdam, implying a block system of two times eight weeks in which the students take two courses in parallel. The remainder of the semester, being four weeks, is meant to work on projects.

The students are informed about the programme by a variety of means of communication, including the programme's website, the Blackboard online learning environment, and email. Additional information may be obtained at the Education Service Center of the Faculty of Science. The programme management has put in place a mentoring system which provides the students with guidance and supervision. Every one of the students has his or her own academic mentor, who is a member of the core staff. Each mentor guides about eight students. The students and the mentor have regular meetings in the course of the year, depending on the students' needs. The mentors assist in designing the students' study path, help the students to find a thesis supervisor and advise them on their career perspectives. The students also have a student mentor, who helps them with practical issues. The students may, also, turn to the programme manager who is very experienced and can assist the students in solving a wide range of problems. The students with whom the panel has discussed this topic, assess the mentoring system to be very useful.

The programme is located at the Science Park campus where the Faculty of Science teaching and learning activities are located. The campus has classrooms, larger lecture rooms, computer rooms, rooms for self-study and a library. The students have their own room (the so-called MoL Room) in which they may study individually or together, and which fulfills an important social role for the students to build their peer network.

Written evaluation forms and a once-a-year general evaluation meeting between students and programme management provide input about the quality and orientation of the programme. The educational committee of the programme advises on issues like the contents of the courses, the structure of the programme and the study load. In a research oriented programme, it is important to regularly renew the curriculum, and create room for new developments. The educational committee and other meetings between students and staff play a key role in this continuous renewal process. Both students and staff seem reasonably happy with the number of courses on offer, their content and their distribution over the four tracks. Issues brought forward by the educational committee and the students are generally dealt with adequately by the programme management.

Considerations
The panel considers the entry requirements for the programme to be relevant and the admission process to be excellent. The programme management is very careful in handling requests for admission by applicants, most of the time advising them against entering the programme, if there is hesitation about the fit. The documentation the applicants submit is quite extensive, and of great help in the selection process. The panel feels the admission procedure is very well designed, allowing only the most talented and motivated students in.

The panel has verified that the intended learning outcomes have all been covered in the programme. Although the study paths of the students are individually designed and match the students' interests, the panel is convinced each one of the students attains the intended learning outcomes of the programme. The mentor assists them in designing a coherent curriculum, meeting the learning outcomes.

Having studied the contents of the courses, the panel assesses the contents of the curriculum not only to meet the intended learning outcomes but also to be of an excellent quality, more than attaining the master's level. The panel regards the curriculum of a very high level, allowing the students to obtain in-depth advanced disciplinary knowledge as well as a broad interdisciplinary perspective on the field of logic. The students are deeply acquainted with scientific research in the courses as well as in the research projects and the thesis. The panel feels this curriculum fits the concept of logic, as described by the programme management very well and allows the students to familiarize themselves fully with this concept.

The panel regards the lecturers to be experts in their field, who are able to teach the students the state of the art of their fields of expertise. The students are brought in a perfect position to obtain in-depth knowledge of the various aspects of logic, at the forefront of the scientific developments. The panel recommends to increase the number of lecturers having a BKO-certificate to further promote the educational capabilities of the lecturers.

The panel has verified that the study load of the programme corresponds to the number of credits. At the same time the panel acknowledges the programme to be very challenging, with respect to the level of the courses as well as with respect to the number of hours the students have to spend. The panel approves of the way in which the programme management is handling the study load issue, by warning the students against overestimating their capabilities and by offering an intensive mentoring system.

The study methods of the programme are in line with the contents of the curriculum, fostering the learning processes of the students. The panel is receptive to the remarks of the students that the University of Amsterdam schedule is not always the best schedule. In some of the courses (e.g. certain mathematical courses), it is difficult to accelerate the learning process to fit into an eight-week period. The panel encourages the programme management to carefully monitor the consequences of the recent change in schedule for the quality and study load of the programme and take appropriate action when needed.

The panel considers the system of academic mentors of the programme to be designed in an excellent manner. The system is intensive and conducive to the learning processes of the students.

The panel regards the housing and the material facilities to be appropriate, especially the students' own MoL-room where they may gather for study and discussion.

The panel is positive about the formal and informal evaluation mechanisms the programme management has put in place, and appreciates that students' input is taken quite seriously in student-staff interactions.

Assessment of this standard
These considerations have led the assessment panel to assess the standard 2 *Teaching-learning environment* to be excellent.

5.3 Standard 3: Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Findings

The University of Amsterdam has drafted an assessment policy document for all of the university's programmes and courses.. The programme's board of examiners is responsible for the quality and the level of the examinations and for ensuring the students attain the programme's intended learning outcomes. Of late, the Faculty of Science has issued a document containing rules and regulations regarding the work of these boards. The programme management is committed to comply with the University's and Faculty's policies. The programme's assessment policy is intended to ensure fair, transparent and accountable examinations.

The examinations are drafted and assessed by the lecturers who give the course to which the examinations refer. The students' grades for the courses tend to be high. The programme's board of examiners studies the syllabi of the courses to assess whether the courses match the learning objectives and meet the required master's level. In a number of cases, the board has acted following remarks by students about courses having too low a level. The board has also advised the lecturers about the grading. In some of the courses, the average grading was found to be too high and the board took measures to remedy this. The board of examiners does not yet systematically assess the examinations of all the courses, but intends to do so in the near future. This will help to ensure the high quality of the teaching, as well as the appropriate and transparent assessment of the students' progress.

The programme management has adopted a number of forms of examination, including homework, take-home examinations, assignments, writing papers, experiments, in-class presentations and written and oral examinations. In a number of courses, the students are being evaluated during the course, e.g. by means of presentations or homework assignments.

Before embarking upon their master's thesis project, the students have to get their research plan approved by the programme director and a member of the board of examiners. During the process of the thesis writing, the students have a thesis supervisor. If the supervisor is someone from outside of the programme, a second supervisor from the core staff of the programme will be assigned to the project. The thesis is assessed by a thesis committee with at least three examiners, including the supervisor, and at least two examiners who have not been involved in the project itself. A member of the board of examiners acts as the chair. The examiners fill out an assessment form, giving their judgment on five criteria, being correctness, writing, difficulty, originality and independence. Originality and independence are not required per se but are determinants to award a cum laude. The students receive a written assessment, explaining the grade they have received. In their meeting with the panel, the students indicated that they are aware of the assessment criteria for the master's thesis assessment, since the supervisors have informed them about these.

The master's theses tend to be very good to excellent. The programme management has presented an overview of the thesis grade distribution of the last two years. From this document it can be derived that the average grade of the theses is about 8.0. As another indication of the level and quality of the theses, it is noted that about 30 % to 40 % of all of the theses have resulted in original peer-reviewed research publications in journals or at important international conferences. Furthermore, a number of students have obtained prestigious prizes for their theses. The programme management has presented a number of examples.

As has been indicated under standard 2 above, the mentors assist the students in obtaining a perspective on their future careers, including helping them to prepare for their careers. Also, the students may inform themselves about career possibilities by screening the alumni network website of the programme. On this website, alumni provide information about their current position.

After having completed the programme, around 67 % of the graduates entered a Ph.D.-programme, mostly at an internationally renowned university in the Netherlands or abroad. Around 33 % of the graduates opt for careers in business. As has been indicated in standard 1 above, the business careers, mostly, include positions as management or technology consultants or as ICT professionals.

Considerations
The panel considers the assessment policy of the programme to be sound and to conform to the University's and Faculty's rules and regulations, taking specific aspects of the examinations of the programme into account. The panel recommends the board of examiners to maintain their position of independence vis-à-vis the programme management. The panel, also, advises the board of examiners to study, more systematically, the examinations of the courses in order to be able to assess the examinations' quality more thoroughly, and ensure fair and transparent grading.

The panel considers the examinations of the courses to be of very good quality and to meet the learning objectives of the courses. The panel regards the master's thesis process and assessment to be sound and to lead to a fair assessment of the theses. Still, the panel recommends the programme management to specify the assessment criteria for the thesis more clearly and to communicate these criteria more explicitly to the students, so they may be better prepared for the thesis assessment.

The panel is impressed by the quality and the level of the master's theses. Having studied a number of these theses, the panel assesses these to have reached a level substantially above the level which may be expected of a master's thesis, and to often report results that could be included in a Ph.D.-thesis. A surprisingly large number of students are doing excellent research. The panel, also, is impressed by the large number of master's theses having led to peer-reviewed publications, often in collaboration with their supervisor.

The majority of the graduates obtain Ph.D.-positions at renowned universities. This is another reason for the panel to assess this programme as one of the best, if not the best programme on logic in the world.

Assessment of this standard
The considerations have led the assessment panel to assess standard 3 *Assessment and achieved learning outcomes* to be excellent.

Annex 1: Schedule of site visit

Amsterdam, 21 June 2013

08.30 h. – 09.30 h.	Arrival and deliberations panel (closed session)
09.30 h. – 10.00 h.	Senior management J. Meerburg LL.M. (director Education, Faculty of Science), A. Pimentel Ph.D. (director Graduate School of Informatics), U. Endriss Ph.D. (programme director)
10.00 h. – 11.20 h.	Programme management U. Endriss Ph.D. (programme director, teacher, mentor, expert Logic & Computation), prof. B. Löwe Ph.D. (chair board of examiners, teacher, mentor, expert Logic & Mathematics), prof. F. Veltman Ph.D. (chair educational committee, teacher, mentor, expert Logic & Philosophy), M. Aloni Ph.D. (teacher, mentor, expert Logic & Language), T. Kassenaar (programme manager)
11.30 h. – 12.15 h.	Board of examiners prof. B. Löwe Ph.D. (chair), M. Aloni Ph.D. (member), A. Baltag Ph.D. (member), prof. J. Groenendijk Ph.D. (member), prof. D. de Jongh (former member)
12.15 h. – 13.30 h.	Lunch, deliberations panel and documents review (closed session), including open office hours 12.15 h. – 12.45 h.
13.30 h. – 14.30 h.	Lecturers, including member of educational committee R. Fernández Ph.D., R. van Rooij Ph.D., prof. M. Stokhof Ph.D., prof. F. Veltman Ph.D. (chair educational committee), prof. Y. Venema Ph.D
14.30 h. – 15.30 h.	Students, including member of educational committee and alumni A. Block BSc (student), I. van de Pol BA (student, member educational committee), C. Qing BSc (student), S. Speitel BA (student), I. Crespo MSc (alumna), A. Reijngoud MSc (alumna), T. Sterkenburg MSc (alumnus)
15.30 h. – 17.15 h.	Deliberations panel and documents review (closed session)
17.15 h. – 17.45 h.	Presentation of main findings by panel's chair to programme management

Annex 2: Documents reviewed

The assessment panel has studied the following documents, presented prior to the site visit:

- Critical reflection of Master of Logic programme
- Reference framework logic, language and information
- Related master's programmes
- Curriculum overview
- Curriculum components
- Teaching and examination regulations
- Guidelines and criteria for assessment of MSc theses
- Academic staff, including BKO and student-teacher ratio
- Programme officials (director and administration, board of examiners, educational committee, academic mentors and student mentors)
- Recent master's theses
- Student publications
- Alumni survey
- Developments since previous accreditation

On the day of the site visit, the programme management presented the following documents:

- List of courses
- Seminar sersies, organised by students
- Course descriptions, materials and literature
- List of January/June projects
- Promotional material (poster, flyer, brochures, email texts, slides for UvA Masterweek events)
- Curricula vitae of core academic staff
- Board of examiners documentation
- Educational committee documentation
- University of Amsterdam Strategic Plan, 2011 – 2014: An Eye for Talent
- University of Amsterdam policy document on teaching
- Faculty of Science policy document on teaching quality
- University of Amsterdam and Faculty of Science policy documents regarding assessment
- Guidelines regarding handicapped students
- Results Nationale Studenten Enquête
- University of Amsterdam survey on staff satisfaction
- Finance model for teaching at Faculty of Science
- Graduate School of Informatics annual report and planning
- Faculty of Science organisation and annual reports
- Minutes of meetings of directors of graduate schools
- Results from student evaluations: individual courses and overall programme
- New careers section on programme website
- List of theses
- Thesis grade distribution
- Graduate destinations (positions after having completed the programme)
- Assessment report of one of the theses
- Self-evaluation, 2006 – 2011, Institute for Logic, Language and Computation
- Research evaluation report, 2006 – 2011, Institute for Logic, Language and Computation

Annex 3: Theses reviewed

The theses of the following full-time students have been selected for review by the panel:

- 5758394
- 6212492
- 0642878
- 6250114
- 6249965
- 6110819
- 5757797
- 6008259
- 6172814
- 0440949
- 0371475
- 6107567
- 6190952
- 5901103
- 5901308

Annex 4: Composition of the assessment panel

The assessment panel had the following composition:

- Prof. H.E. de Swart Ph.D., panel chair, professor in French Linguistics and Semantics, Utrecht University, with a special appointment as a core member of the Cognitive Artificial Intelligence programme;
- Prof. J.F. Horty Ph.D., panel member, professor, Philosophy Department and Institute for Advanced Computer Studies and affiliate professor, Computer Science Department, University of Maryland;
- Prof. C. Stirling Ph.D., panel member, professor in Computer Science, School of Informatics, Edinburgh University;
- A.M.A. Kangur BSc, student member, student in the master's programme Artificial Intelligence, University of Groningen.

Prof. H.E. de Swart Ph.D., panel chair
Since 1997, Mrs De Swart is a full professor in French Linguistics and Semantics at Utrecht University, having a special appointment as a core member of the Cognitive Artificial Intelligence programme. She obtained her Ph.D. in 1991 from University of Groningen. Among other positions, she has been an assistant professor in Linguistics at Stanford University. Currently, she is the scientific director of the Utrecht Institute of Linguistics. Mrs De Swart sits on the editorial boards of a number of scientific journals in her field of expertise and has published books and articles in journals and in edited volumes.

Prof. J.F. Horty Ph.D., panel member
Since 1999, Mr Horty is a professor at the Philosophy Department and Institute for Advanced Computer Studies and an affiliate professor at the Computer Science Department of University of Maryland. From 2009 to 2012, he was the chair of the Philosophy department. He obtained his Ph.D. from the University of Pittsburgh. His research interests include philosophical logic, cognitive science and logic and artificial intelligence. Mr Horty is a reviewer of a number of scientific journals and has published a number of monographs as well as numerous articles in scientific journals.

Prof. C. Stirling Ph.D., panel member
Since 1995, Mr Stirling is a professor in Computer Science at the School of Informatics of Edinburgh University. He holds the personal chair of Computation Theory. His first appointment at Edinburgh University was in 1982. He obtained his Ph.D. from York University, in 1982. He has been a member of programme committees of numerous international conferences and has held lectures at a substantial number of universities. Mr. Stirling sits on the editorial boards of a number of scientific journals has published a number of books as well as numerous articles in scientific journals.

A.M.A. Kangur BSc, student member
Since 2012, Ms Kangur is student in the master's programme Artificial Intelligence at the University of Groningen, after having completed the corresponding bachelor's programme at this university. She, also, is a student-assistant for the research group Sensory Cognition of the department of Artificial Intelligence of this university. Ms Kangur has been a student member in a number of committees and boards within the University of Groningen.

Annex 5: Declarations of independence