

Assessment report
Limited Framework Programme Assessment

Master Stochastics and Financial Mathematics

University of Amsterdam

Contents of the report

1. Executive summary	2
2. Assessment process	4
3. Programme administrative information.....	7
4. Findings, considerations and assessments per standard	8
4.1 Standard 1: Intended learning outcomes	8
4.2 Standard 2: Teaching-learning environment	11
4.3 Standard 3: Student assessment.....	13
4.4 Standard 4: Achieved learning outcomes	15
5. Overview of assessments.....	16
6. Recommendations	17

1. Executive summary

In this executive summary, the panel presents the main considerations which led to the assessment of the quality of the Master Stochastics and Financial Mathematics programme of University of Amsterdam. The programme was assessed according to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, published on 20 December 2016 (Staatscourant nr. 69458).

The panel appreciates the programme objectives to educate students in the stochastics and financial mathematics domain at advanced levels, to introduce them to data science and stochastic modelling and programming, and to train them in research skills and general academic skills. The panel notes the collaboration with Vrije Universiteit Amsterdam has been continued.

The panel considers the Domain-Specific Framework of Reference to be an appropriate description of the mathematics discipline and of the standards and requirements graduates of both bachelor and master programme have to meet. The panel welcomes the efforts of the joint Mathematics programmes in the Netherlands to have drafted the Framework. The panel finds it, however, important to specify the societal specialisations more clearly in the Framework. The objectives and intended learning outcomes of this programme meet the Framework and, therefore, correspond to international standards set for the discipline. The panel suggests to cover knowledge of fields in mathematics, other than stochastics more comprehensively in the intended learning outcomes, and proposes to add ethical awareness to the intended learning outcomes, this being specified in the Framework.

The panel encourages the programme to continue along the lines set out by the Task group mathematics education of the Korteweg-de Vries Institute. To promote this process, the panel recommends to install a curriculum committee for the programme.

The programme intentions to prepare students for academic careers or for careers in the professional field are welcomed by the panel. The panel approves of the majors and minors offered in the programme. The panel notes that very few students take majors or minors.

The panel suggests to consider the relation between this programme and the Stochastics track in the Master Mathematics programme of University of Amsterdam.

The intended learning outcomes of the programme meet the programme objectives and are conform to the master level. The panel advises to articulate the intended learning outcomes more clearly.

The panel notes that the influx in the programme is quite low and, therefore, advises to raise the number of incoming students. The panel approves of the admission requirements and entry procedures of the programme. Students are adequately informed about the programme at the start.

The programme curriculum matches the intended learning outcomes. The panel regards the courses to be solid and the curriculum to be of good quality. The Master seminar is valuable, allowing students to practice academic skills in the programme domain. Mastermath is also positively regarded, as it offers a wide range of high-level courses in various fields. As some of these courses may have become more

challenging, the panel suggests to discuss this with Mastermath management. The panel advises to give the subject of ethics more emphasis in the curriculum.

The staff members lecturing in the programme have very solid research backgrounds and are motivated teachers. Their educational capabilities are up to standard. Students regard the lecturers to be easily approachable and ready to assist them. Although the work load of lecturers is manageable, the panel welcomes extra staff being recruited. The panel suggests to pay attention to the educational capabilities of candidates in the staff members recruitment processes.

The educational concept and study methods in the programme are effective. The study guidance is satisfactory. The panel proposes to consider the study load in the programme. The material facilities are adequate. As the drop-out rate and student success rates are somewhat disappointing, the panel proposes to monitor both figures and to hold exit interviews on the reasons for students to leave.

The panel approves of the programme examinations and assessment rules and regulations. The panel is positive about the position and activities of the Examinations Board. The panel considers the measures taken by the programme to assure the quality of examinations and assessments to be appropriate. The panel approves of the quality control of the Mastermath examinations by the Examinations Board.

The examination methods in the programme are adequate, being consistent with the goals of the courses. The policies to curtail the effects of any free-riding are appropriate.

The supervision and assessment processes for Master projects have been well-organised. The panel, however, advises to add more extensive arguments to substantiate the Master projects assessments. The panel welcomes Examinations Board members chairing Master project assessment proceedings.

The examinations of the courses are of appropriate level. The panel assesses the Master projects to be adequate. The panel supports the grades awarded to the projects. In some cases, the panel would have given slightly lower grades. No Master projects were found to be unsatisfactory.

The career orientation activities of the programme allow students to be prepared for the professional field. The panel is convinced the programme graduates have reached the intended learning outcomes of the programme. The panel advises to reinforce the relations with the programme alumni.

The panel that conducted the assessment of the Master Stochastics and Financial Mathematics programme of University of Amsterdam assesses this programme to meet the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, judging the programme to be *satisfactory*. Therefore, the panel recommends NVAO to accredit this programme.

Rotterdam, 27 September 2019

Prof. dr. ir. O.J. Boxma
(panel chair)

drs. W. Vercouteren
(panel secretary)

2. Assessment process

The evaluation agency Certiked VBI received the request by University of Amsterdam to support the limited framework programme assessment process for the Master Stochastics and Financial Mathematics programme of this University. The objective of the programme assessment process was to assess whether the programme conforms to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, published on 20 December 2016 (Staatscourant nr. 69458).

Management of the programmes in the assessment cluster WO Wiskunde convened to discuss the assessment panel composition and to draft the list of candidates. The panel composition for this assessment has been based upon these considerations.

Having conferred with University of Amsterdam programme management, Certiked invited candidate panel members to sit on the assessment panel. The panel members agreed to do so. The panel composition was as follows:

- Prof. dr. ir. O.J. Boxma, full professor Stochastic Operations Research, Eindhoven University of Technology (panel chair);
- Prof. dr. R.H. Kaenders, full professor Mathematics and its Education, University of Bonn, Germany (panel member);
- Prof. dr. D. van Straten, full professor Algebraic Geometry, Johannes Gutenberg University Mainz, Germany (panel member);
- Dr. ir. H.J. Prins, manager Research & Development, Maritime Research Institute the Netherlands (panel member);
- L. Weedage BSc, student Master Applied Mathematics, University of Twente (student member).

On behalf of Certiked, drs. W. Vercouteren served as the process coordinator and secretary in the assessment process.

All panel members and the secretary confirmed in writing being impartial with regard to the programme to be assessed and observing the rules of confidentiality. Having obtained the authorisation by the University, Certiked requested the approval of NVAO of the proposed panel to conduct the assessment. NVAO have given their approval.

To prepare the assessment process, the process coordinator convened with management of the programme to discuss the planning of the activities in preparation of the site visit. The site visit schedule was also discussed. In addition, the outline of the self-assessment report and the subjects to be addressed in this report were part of the discussion.

In the course of the process preparing for the site visit, programme management and the Certiked process coordinator had contact to fine-tune the process. The activities prior to the site visit have been performed as planned. Programme management approved the site visit schedule.

Well in advance of the site visit date, programme management sent the list of final projects of graduates of the programme of the most recent years. Acting on behalf of the assessment panel, the

process coordinator selected the final projects of fifteen graduates from these years. The grade distribution in the selection was conform to the grade distribution in the list, sent by programme management.

The panel chair and the panel members were sent in time the self-assessment report of the programme, including appendices. In the self-assessment report, the student chapter was included. In addition, the expert panel members were forwarded a number of theses of the programme graduates, these theses being part of the selection made by the process coordinator.

Before the site visit date, the assessment panel chair and the process coordinator met to discuss the self-assessment report to be provided by programme management, the procedures regarding the assessment process and the site visit schedule. In this meeting, the profile of panel chairs of NVAO was discussed as well. The panel chair was comprehensively informed about the competencies, listed in the profile.

Being informed by the process coordinator, all panel members sent in their preliminary findings, based on the self-assessment report and the final projects studied, and a number of questions to be put to the programme representatives on the day of the site visit. The panel secretary summarised this information, compiling a list of questions, which served as a starting point for the discussions with the programme representatives during the site visit.

Shortly before the site visit date, the panel met to go over the preliminary findings concerning the quality of the programme. During this meeting, the preliminary findings of the panel members, including those about the theses were discussed. The procedures to be adopted during the site visit, including the questions to be put to the programme representatives on the basis of the list compiled, were discussed as well.

On 5 July 2019 and 8 July 2019, the panel conducted the site visit on the University of Amsterdam campus. The site visit schedule was as planned. In a number of separate sessions, the panel was given the opportunity to meet with Faculty Board representatives, programme management, Examinations Board members, lecturers and final projects examiners, students, and alumni.

In a closed session near the end of the site visit, the panel considered every one of the findings, weighed the considerations and arrived at conclusions with regard to the quality of the programme. At the end of the site visit, the panel chair presented a broad outline of the considerations and conclusions to programme representatives.

Clearly separated from the process of the programme assessment, the assessment panel members and programme representatives met to conduct the development dialogue, with the objective to discuss future developments of the programme.

The assessment draft report was finalised by the secretary, having taken into account the findings and considerations of the panel. The draft report was sent to the panel members, who studied it and made a number of changes. Thereupon, the secretary edited the final report. This report was presented to programme management to be corrected for factual inaccuracies. Programme management were given two weeks to respond. Having been corrected for these factual inaccuracies, the Certiked bureau sent the report to the University Board to accompany their request for re-accreditation of this programme.

3. Programme administrative information

Name programme in CROHO: M Stochastics and Financial Mathematics
Orientation, level programme: Academic Master
Grade: MSc
Number of credits: 120 EC
Specialisations: Science Communication
Science in Society
Teaching
Location: Amsterdam
Mode of study: Full-time
Language of instruction: English
Registration in CROHO: 21PK-60801
Name of institution: University of Amsterdam
Status of institution: Publicly funded body providing higher education
Institution's quality assurance: Approved

4. Findings, considerations and assessments per standard

4.1 Standard 1: Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings

The Master Stochastics and Financial Mathematics programme is one of the master programmes of the Faculty of Science of University of Amsterdam. The dean of the Faculty has the responsibility for all programmes of the Faculty. This master programme is part of the Graduate School of Sciences of this Faculty. The programme is organised by the Korteweg-de Vries Institute for Mathematics, being one of the institutes of the Faculty. The director of the programme is responsible for the contents, the organisation and the quality of the programme. The programme director is assisted by the programme coordinator and the study advisor. The Programme Committee for the Bachelor Mathematics, Master Mathematics and Master Stochastics and Financial Mathematics programmes, being composed of equal numbers of lecturers and students, advises programme management on quality issues. The Examinations Board Mathematics assures the quality of examinations and assessments of these three programmes. This Board is part of the Examinations Board Exact Sciences and Information Sciences of the Faculty of Sciences. The programme is offered in collaboration with the Department of Mathematics of Vrije Universiteit Amsterdam. University of Amsterdam mainly brings in the expertise on financial mathematics, whereas Vrije Universiteit Amsterdam primarily contributes expertise on data science.

The objectives of the programme are to acquaint students in-depth with knowledge of and skills in the fields of stochastics and financial mathematics. Students are also educated in data analysis and in stochastic modelling and programming. In addition, students are trained in research skills and in general academic skills in these domains.

The joint Mathematics programmes in the Netherlands drafted the Domain-Specific Framework of Reference for both Bachelor and Master Mathematics programmes. In this Domain-Specific Framework of Reference, the generic objectives and the generic intended learning outcomes for these programmes have been listed. These objectives and intended learning outcomes meet the international standard for mathematics of ASIIN in Germany. They also correspond to the Dublin descriptors and the Meijers' criteria. In addition, they are largely comparable to those of the Mathematics programmes of renowned universities abroad, such as ETH Zürich, KU Leuven and University of Padova.

Students are prepared for entering the labour market. Students are educated to either proceed to PhD trajectories or to find positions in the professional field. The programme offers majors and minors, leading to societal specialisations. The majors are Science Communication, Science in Society or Teaching. The majors include 60 EC of non-mathematics courses, to prepare students for positions in the field of communication about science (Science Communication), in science-related management or business (Science in Society) or as fully-qualified teacher in Mathematics in secondary education (Teaching). The minors (30 EC) are the Teaching minor, leading to the position of fully-qualified teacher in Mathematics in secondary education, following the Education minor in the Bachelor

Mathematics, the Science for Sustainability minor or the Tesla minor, teaching students to apply exact sciences in societal or business contexts. The number of students taking majors or minors is very limited. In addition, students may take the double Master Stochastics and Financial Mathematics and Econometrics programme.

Following the mid-term evaluation of 2016, the Korteweg-de Vries Institute installed the Task group mathematics education. The Task group drafted plans for the continuing development of the three programmes, offered by the Institute.

The objectives of the programme have been translated into intended learning outcomes. These include, as main elements, thorough theoretical and practical knowledge of stochastics and financial mathematics; research skills in this domain; knowledge and skills to model and analyse phenomena in stochastic mathematical terms; awareness of societal position and role of stochastics and financial mathematics; and general academic skills. In addition to these programme intended learning outcomes, specific intended learning outcomes have been drafted for all majors and minors.

The intended learning outcomes of the programme have been compared to the Dublin descriptors for master programmes, to establish their master level.

Considerations

The panel appreciates the programme objectives to educate students in the stochastics and financial mathematics domain at advanced levels, to introduce them to data science and stochastic modelling and programming, and to train them in research skills and general academic skills.

The panel considers the Domain-Specific Framework of Reference to be an appropriate description of the mathematics discipline and of the standards and requirements graduates of both bachelor and master programme have to meet. The panel welcomes the efforts of the joint Mathematics programmes in the Netherlands to have drafted the Framework. The panel finds it, however, important to specify the societal specialisations more clearly in the Framework. The objectives and intended learning outcomes of this programme meet the Framework and, therefore, correspond to international standards set for the discipline. The panel suggests to cover knowledge of fields in mathematics, other than stochastics more comprehensively in the intended learning outcomes, this being specified in the Framework. The panel proposes to add ethical awareness to the intended learning outcomes, this also being specified in the Framework.

The panel regards the recommendations of the Task group mathematics education of the Korteweg-de Vries Institute for Mathematics to be valuable and encourages the programme to continue along the lines set out in the Task group report. To promote this process, the panel recommends to install a curriculum committee for the programme.

The programme intentions to prepare students for both academic careers or for careers in the professional field are welcomed by the panel. The panel approves of the majors and minors offered in the programme. The panel notes that very few students take majors or minors.

The panel suggests to consider the relation between this programme and the Stochastics track in the Master Mathematics programme of University of Amsterdam, to clarify the distinction between the programmes and to convince students of the value of this programme.

The intended learning outcomes of the programme correspond to the programme objectives and are conform to the master level. The panel advises to articulate the intended learning outcomes more clearly.

Assessment of this standard

These considerations have led the assessment panel to assess standard 1, Intended learning outcomes, to be satisfactory.

4.2 Standard 2: Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings

The number of students entering the programme remained rather stable in the years from 2010 to 2017, being on average 12 incoming students per year and ranging from 7 to 18 students per year. About 40 % of the intake are foreign students. All applications are screened by the Master Mathematics and Master Stochastics and Financial Mathematics Admissions Board. The entry requirements for this programme are Bachelor Mathematics degrees from Dutch universities. Students with Bachelor Econometrics degrees are admitted, after having remedied some deficiencies. As a rule, students with bachelor degrees in other disciplines are not admitted. In specific cases, these students may be admitted, sometimes after having completed the pre-master programme (maximum 30 EC). Foreign students may enrol in case of equivalent prior education. At the start of the programme, students are invited to meet with fellow students and programme management. They are assisted by the programme coordinator in drafting their personal study plan. Foreign students having difficulties in adapting to programme requirements are supported by the programme coordinator or study advisor.

The study load of the curriculum is 120 EC. The curriculum takes two years to complete. Programme management presented a table, showing the curriculum to cover all of the intended learning outcomes. The compulsory components in the curriculum are the course *Measure Theoretic Probability* in the first semester, the Master seminar in the first year and the Master project in the second year. The course *Measure Theoretic Probability* lays the foundations for other, more advanced courses in the curriculum. Up to 2017/2018, students joined the Master Seminar Stochastics of the Master Mathematics programme. From 2018/2019 onwards, students take the programme's own Master Stochastics and Financial Mathematics Seminar. In the seminar, students study in small groups specific academic topics on the basis of academic literature. The seminar exposes students to recent and relevant subjects and trends in the programme domain, develops their presentation skills and informs them about career options. In the Master seminar, first-year students give presentations on the articles or books studied and second-year students give mid-term presentations on their Master project. In addition to the compulsory curriculum components, students select elective courses, some of which have to be chosen from lists of constrained electives. Students tend to take about 35 % of their courses from Mastermath. Some courses are offered by Vrije Universiteit Amsterdam. In the newly scheduled SFM Internship course (3 EC), students may work on practical problems within the professional field. At the end of the curriculum, students individually complete the compulsory Master project (36 EC). In the majors or minors, students take 60 EC or 30 EC of management-, business- or teaching-oriented courses. The study load of the Master project in majors or minors is reduced to 24 EC.

The number of permanent staff lecturing in the programme are 12 lecturers. All of the lecturers in the programme are staff members of the Korteweg-de Vries Institute of the Faculty of Science of University of Amsterdam. All staff members are active researchers in their respective fields and all of them have PhD degrees. About 83 % of the staff members are BKO-certified. Lecturers are free to organise their lectures, as long as course goals are met. Lecturers meet on a regular basis to discuss the programme. New courses are being introduced as the result of these discussions. Students appreciate

lecturers' capabilities and accessibility. Lecturers experience the work load as manageable. The Mathematics sector plan will allow to recruit additional lecturers in the fields of, among others, statistics and data analysis.

The educational concept of the programme is research-based education, fostering students' academic attitudes. The study methods in the courses of the programme are lectures, tutorials and self-study. In the Master seminar, the study methods are participation, presentations and self-study. The students-to-staff ratio in the programme is 46/1. The number of hours of face-to-face education is about 8 to 15 hours per week in the first three semesters. The number of students in the non-Mastermath classes tends to be 10 to 20 students, leading to small-scale education. In the Mastermath classes, up to 50 students may be in class. The Master seminar Stochastics and Financial Mathematics is meant to promote the community feeling among students in the programme. Students find the curriculum challenging. The drop-out rate in the programme is on average 28 %, calculated over the last eight years. The average student success rates are 32 % after two years and 58 % after three years (last six to seven cohorts).

Considerations

The panel notes that the influx in the programme is quite low and, therefore, advises to raise the number of incoming students. The panel approves of the admission requirements and entry procedures of the programme. Students are adequately informed about the programme at the start.

The curriculum of the programme matches the intended learning outcomes. The panel regards the courses to be solid. The panel considers the curriculum to be of good quality. The Master seminar is valuable, allowing students to practice a wide range of academic skills in the programme domain. Mastermath is also positively regarded, as it offers a wide range of high-level courses in various fields. As some of these courses may have become more challenging, the panel suggests to discuss this with Mastermath management. The panel advises to give the subject of ethics more emphasis in the curriculum, this being an important subject for the programme.

The staff members lecturing in the programme have very solid research backgrounds in the fields they are lecturing in. They are also motivated teachers. Their educational capabilities are up to standard. Students regard the lecturers to be easily approachable and ready to assist them. Although the work load of lecturers is manageable, the panel welcomes extra staff being recruited. The panel suggests to pay attention to the educational capabilities of candidates in the staff members recruitment processes.

The educational concept and the study methods adopted in the programme are regarded by the panel to be effective. The study guidance in the programme is satisfactory. The panel proposes to consider the study load in the programme. The material facilities for the programme are adequate. The panel finds the drop-out rate of this master programme to be quite substantial. The student success rates are somewhat disappointing. Therefore, the panel proposes to monitor both figures and to hold exit interviews on the reasons for students to leave.

Assessment of this standard

These considerations have led the assessment panel to assess standard 2, Teaching-learning environment, to be satisfactory.

4.3 Standard 3: Student assessment

The programme has an adequate system of student assessment in place.
--

Findings

The programme examination and assessment procedures are laid down in the assessment plan for the programme. These procedures are aligned with the University of Amsterdam assessment policies and the Faculty of Science rules and regulations. The examinations and assessments are governed by the principles of constructive alignment, linking the course examinations to the programme intended learning outcomes. As has been indicated, the Examinations Board Mathematics monitors the quality of examinations and assessments of this programme.

The examination methods adopted in the courses are written examinations, oral examinations, homework exercises, participation in class and presentations. The examinations are aligned with the course goals. In most of the courses, multiple examinations are scheduled. The weight of homework assignments is limited to 40 % of the final course grade. For individual examinations, students have to obtain at least the grade 5.0 out of 10.

At the end of the curriculum, students are to complete the individual Master project. Projects are either conducted within the Korteweg-de Vries Institute or as internships with consultancies or financial companies. About 40 % of the students do internships. Students are guided individually by one of the staff members as academic supervisor, whom they tend to meet weekly. PhD students may be involved in day-to-day supervision. In internships, students are also guided by company supervisors. The academic supervisors assure the academic level of the project. Students give presentations on intermediate results in the Master seminar. The projects are assessed by the supervisor and the second reader, both of them being staff members. The examiners assess the projects on the basis of assessment criteria. These criteria are written report (50 % of grade), attitude and execution (35 %), interim presentation (5 %) and final presentation (10 %). One of the members of the Examinations Board is the independent chair of the Master project assessment proceedings to assure procedures are being adhered to. All Master projects are checked for plagiarism. The Examinations Board handles plagiarism cases. Such cases are rare.

Programme management and the Examinations Board have taken a number of measures to promote the quality of the examinations and assessments. The Examinations Board appoints the examiners for every one of the courses. Draft examinations are peer-reviewed by fellow examiners. Answer keys to assess and grade examinations are used. Students are informed about the scheduling and the grading rules for examinations. They are also entitled to inspect their marked examinations. On a regular basis, the Examinations Board inspects the course files and examinations of a number of courses.

The Examinations Board monitors the contents and quality of the Mastermath courses and examinations. Mastermath presents the course records, examination reports and the names of the examiners for the courses to the examination boards of the participating universities. These boards verify the quality of the courses and of the examinations. If one board, notably the board of the university offering the course, approves of the quality, the other boards accept this decision as their own. The examination boards of all programmes, participating in Mastermath, meet yearly to discuss

the Mastermath examinations' and assessments' quality assurance. The Teaching and Examination Regulations of this University of Amsterdam programme apply for the Mastermath courses.

Considerations

The panel approves of the examinations and assessment rules and regulations of the programme, these being in line with University of Amsterdam and Faculty of Science policies. The panel is positive about the position and the activities of the Examinations Board.

The panel approves of the examination methods adopted by the programme. The examination methods are consistent with the goals of the courses. The policies to curtail the effects of any free-riding are appropriate.

The supervision and assessment processes for Master projects have been well-organised. Students are offered appropriate supervision. The panel is positive about students being offered the opportunity to do the projects as internships. The assessment procedures are up to standard, involving two examiners. The panel, however, advises to add more extensive arguments to substantiate the assessments of the Master projects. These may take the form of concise comments on the selection of the topic of the thesis, the preparation of the student on the subject concerned, the summary of the contents of the thesis, the specification of the own contributions by the student, the creativity and mathematical depth of the student contributions and the quality of writing and oral presentation by the student. The panel welcomes members of the Examinations Board chairing the Master project assessment proceedings, as this strengthens the procedures and promotes the calibration of grades across the projects.

The panel considers the measures taken by the programme to assure the quality of examinations and assessments to be appropriate. The panel regards these measures as assuring valid, reliable and transparent examinations and assessments. The panel feels the constructive alignment principles of the programme should not efface the intrinsic motivation of students. The panel approves of the regulations regarding the Mastermath examinations and the quality control of these examinations by the Examinations Board.

Assessment of this standard

The considerations have led the assessment panel to assess standard 3, Student assessment, to be satisfactory.

4.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

The panel studied the examinations of a number of courses of the programme.

The panel reviewed the Master projects of fifteen graduates of the programme with different grades. In the Master projects, students are to demonstrate mastering nearly all intended learning outcomes of the programme. The average grade of the Master projects is 8.1 for the last 30 graduates.

In the curriculum, career orientation activities are scheduled. In the Master seminar, professional field representatives and researchers, including PhD students, inform students about their work. Concise internships (3 EC) are scheduled in the programme, from 2018 onwards. First-year students are obliged to attend the University of Amsterdam Quants Career Event, allowing them to meet with professional field representatives. Many students do Master projects as internships, allowing them to become acquainted with the professional practice.

Programme graduates are prepared to enter the labour market. About 20 % to 25 % of the graduates proceed to PhD trajectories in mathematics in the Netherlands or abroad. Other graduates find appropriate positions in, among others, financial institutions, insurance companies, consultancies or semi-governmental organisations. Programme graduates tend to find positions shortly after graduation.

Considerations

The examinations of the courses which were reviewed by the panel are of appropriate level.

The panel assesses the Master projects to be appropriate. Although the quality of the projects varies, the average quality of the projects is adequate. The panel supports the grades awarded to the projects. In some cases, the panel would have given slightly lower grades. No Master projects were found to be unsatisfactory.

The career orientation activities of the programme allow students to be prepared for the professional field.

The panel is convinced the programme graduates have reached the intended learning outcomes of the programme. Programme graduates find suitable positions easily. The panel advises to reinforce the relations with the programme alumni.

Assessment of this standard

The considerations have led the assessment panel to assess standard 4, Achieved learning outcomes, to be satisfactory.

5. Overview of assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Satisfactory
Standard 2: Teaching-learning environment	Satisfactory
Standard 3: Student assessment	Satisfactory
Standard 4: Achieved learning outcomes	Satisfactory
Programme	Satisfactory

6. Recommendations

In this report, a number of recommendations by the panel has been listed. For the sake of clarity, these have been brought together below.

- To cover knowledge of fields in mathematics, other than stochastics more comprehensively in the intended learning outcomes.
- To add ethical awareness to the programme intended learning outcomes.
- To consider the relation between this programme and the Stochastics track in the Master Mathematics programme of University of Amsterdam, to clarify the distinction between the programmes and to convince students of the value of this programme.
- To articulate the intended learning outcomes more clearly.
- To install a curriculum committee for the programme.
- To raise the number of incoming students.
- To give the subject of ethics more emphasis in the curriculum.
- To discuss the challenging nature of some Mastermath courses with Mastermath management.
- To make the educational capabilities of candidates part of the staff members recruitment processes.
- To consider the study load in the programme.
- To monitor the drop-out rates and the student success rates of the programme.
- To hold exit interviews on the reasons for students to leave.
- To add more extensive comments and arguments to substantiate the assessments of the Master projects.
- To reinforce the relations with the programme alumni.