Assessment report
Limited Framework Programme Assessment

Bachelor Mathematics

University of Amsterdam

Contents of the report

1. Executive summary

In this executive summary, the panel presents the main considerations which led to the assessment of the quality of the Bachelor 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 main fields within the mathematics discipline, to introduce them broadly to the theory and practice of mathematics, and to train them in research skills and in 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 this 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 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 panel welcomes students being educated to enrol in master programmes in mathematics, but also in master programmes in other disciplines. The panel is pleased that the Education minor is offered to allow students to become mathematics teachers in secondary education.

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

The panel notes that the number of incoming students is satisfactory. As the influx of the last few years did, however, not keep up with national trends of rising intake, the panel proposes to raise the number of incoming students. The panel approves of the admission requirements and entry procedures of the programme. In the first year, students are appropriately taught how to study mathematics.

The curriculum of the programme matches the intended learning outcomes. The panel regards the courses to be very strong in terms of both breadth and depth. The panel considers the curriculum to be of high quality. Some courses within the curriculum are regarded by the panel to be specially valuable. The research skills training and academic skills training are appropriate. The panel would like to make some recommendations to improve the curriculum further. The teaching-learning trajectory Analysis could be made more consistent. The fields of numerical analysis, modelling and programming and the subject of ethics could be strengthened. Discrete mathematics may be given somewhat more attention.

The programme lecturers 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 proposes to pay attention to the educational capabilities of candidates in staff members recruitment processes. The panel suggests to intensify teaching assistants training.

The educational concept and the study methods in the programme are effective. The panel welcomes the study guidance by the tutors and the study advisor. The material facilities for the programme are adequate. The panel proposes to balance the study load in the programme. As the drop-out rates and student success rates of the programme may be regarded to be somewhat disappointing, the panel recommends to monitor these and to hold exit interviews on the reasons for students to leave.

The examinations and assessment rules and regulations of the programme are appropriate. The panel is positive about the position and the activities of the Examinations Board. The measures taken by the programme to assure the quality of examinations and assessments are adequate.

The panel approves of the examination methods adopted by the programme, these being consistent with the course goals. The processes of marking examinations are adequate. Policies to curtail effects of any free-riding are adequate. The panel advises to avoid teaching assistants reviewing draft examinations and grading examinations without examiners' supervision.

The supervision and assessment processes for Bachelor projects have been well-organised. Students are offered appropriate supervision. The assessment procedures are up to standard, involving two examiners assessing the student's work on the basis of relevant criteria. The panel, however, advises to add more extensive arguments to substantiate the assessments of the Bachelor projects.

The course examinations are of very appropriate level. The Bachelor projects are up to standard. Although the quality varies, the average quality of the projects is good. The panel supports the grades awarded to the projects. In some cases, the panel would have given somewhat higher grades. No Bachelor projects were found to be unsatisfactory.

The panel is convinced the programme graduates have reached the intended learning outcomes of the programme. Programme graduates have access to master programmes in a wide range of domains. The panel advises to reinforce the relations with the programme alumni.

The panel that conducted the assessment of the Bachelor Mathematics programme of University of Amsterdam assesses the programme to meet the limited framework standards, 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 Bachelor 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:	B Mathematics (B Wiskunde)
Orientation, level programme:	Academic Bachelor
Grade:	BSc
Number of credits:	180 EC
Specialisations:	None
Location:	Amsterdam
Mode of study:	Full-time
Language of instruction:	Dutch
Registration in CROHO:	21PK-56980
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 Bachelor Mathematics programme is one of the bachelor 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 bachelor programme is part of the College of Science of this Faculty. The programme is hosted 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, among others, 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 objectives of the programme are to educate students broadly in the theoretical and practical foundations of the mathematics discipline, to introduce them to mathematical reasoning and to teach them mathematical problem-solving. Students are acquainted with applications of mathematics. They are also trained in research skills and in general academic skills.

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 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, Cambridge University and University of Padova.

In addition to the regular programme, students are offered the double Bachelor Mathematics and Physics and Bachelor Mathematics and Computer Science programmes. At the end of the first semester, motivated and talented students may take the Honours programme of 30 EC of additional courses. Students may take the Education minor to become mathematics teachers in secondary education.

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.

Students are not educated to directly enter the labour market, although some students may do so. They are prepared for continuing their education at master level in the mathematics discipline. Students may also proceed to master programmes in disciplines, such as physics, computational science, artificial intelligence or logic.

The objectives of the programme have been translated into the intended learning outcomes of the programme. These include, as main elements, theoretical and practical knowledge of the main fields within the mathematics discipline; being capable of abstract and rigorously logical reasoning as is characteristic for mathematics; awareness of applications of mathematics in other sciences and in society; basic research skills; critical and independent judgment; communication skills; and to meet the entry requirements for mathematics programmes at master level.

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

Considerations
The panel appreciates the programme objectives to educate students in the main fields within the mathematics discipline, to introduce them broadly to the theory and practice of mathematics, and to train them in research skills and in general academic skills. The panel regards the programme objectives to be sound, introducing students appropriately to the mathematics discipline.

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 this 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 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 educate students to continue their studies at master level are supported by the panel. The panel welcomes students being educated to enrol in master programmes in mathematics, but also in master programmes in other disciplines. The panel is pleased that the Education minor is offered to allow students to become mathematics teachers in secondary education.

The programme intended learning outcomes meet the programme objectives and are conform to the bachelor 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 relatively stable in the last seven years, going from 61 incoming students in 2012 to 77 students in 2015 to 74 students in 2018. The entry requirements are the Dutch secondary school diploma, including the Mathematics B certificate. Prospective students are informed about the programme through the programme website and on information days. All applicants have to attend matching days. These include lectures, tutorials and tests. Thereupon, applicants are given non-binding advice on their enrolling in the programme. In the first-year tutoring system sessions (*tutoraat*), students are guided by third-year bachelor students or master students in learning how to study mathematics, to approach mathematical problems and to give mathematical proofs. These sessions take about four to six hours and about 15 to 20 students are in class. Students appreciate the tutoring system.

The study load of the curriculum is 180 EC. The curriculum takes three years to complete. Programme management presented a table, showing the curriculum to cover all of the intended learning outcomes. The curriculum is organised in teaching-learning trajectories, being Analysis, Algebra/Geometry, Stochastics, Logic and Academic skills. The courses in the first year of the curriculum are compulsory and cover nearly all fields within the mathematics discipline. The courses in the second year continue laying the foundations for the discipline. In the second and third year, students may select one of the tracks offered in the programme. The tracks are Algebra and geometry, Analysis, Stochastics, Modelling and applications, Logic and Education. Tracks consist of three constrained elective courses (18 EC). In addition to these constrained electives, students take 30 EC of free electives. They may also take one of the minors of University of Amsterdam or other institutions or may go abroad. About 10 % to 15 % of the students take the latter option. At the end of the curriculum, students individually draft the Bachelor project (12 EC). Students are trained in academic skills, such as critical thinking, studying academic literature, working together in teams, using mathematics software tools, academic writing and oral presentations. Skills training is part of a number of courses and is addressed in the projects, scheduled in all three years of the curriculum. Skills training in the programme is coordinated by the skills training coordinator.

The number of permanent staff lecturing in the programme are 49 lecturers in total. Nearly 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 lecturers are active researchers in their respective fields and practically all of them have PhD degrees. About 94 % of the staff members are BKO-certified. Some lecturers from other institutes of University of Amsterdam or from Vrije Universiteit Amsterdam are involved in the programme. Teaching assistants, being PhD students and master students, teach in the programme. In fact, a considerable part of the lecturing is in the hands of these teaching students. Teaching assistants receive some training for their work. 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 programme educational concept is to familiarise students with abstract and rigorous reasoning, which is inherent in mathematics and to achieve this working together with others. The study methods in the courses of the programme are lectures, tutorials, projects and tutor system sessions. In the first two years, attendance in tutorials is mandatory. In the tutorials, students work either individually or in small groups to solve problems. Students hand in homework assignments, and are given feedback on these. The number of hours of face-to-face education is 18 hours per week in the first year and 11 to 12 hours per week in the second and third year. The number of hours in the first year is higher because of the scheduling of tutor system sessions. The programme students-to-staff ratio is 16/1, allowing for small-scale education. Some courses are spread over 16 weeks instead of the customary eight weeks to allow students to digest course contents. Students, however, experience the courses as challenging and the study load as high. For guidance on choices to be made in the curriculum or for study-related questions or problems, students may turn to the programme study advisor. The tutors in the tutor system sessions in the first year work closely together with the study advisor. The drop-out rate of the programme is on average 37 %, calculated for the last six years. The average student success rates are 41 % after three years and 61 % after four years (last three to four cohorts; proportions of students re-entering the programme in the second year).

Considerations
The panel notes that the number of incoming students is satisfactory. As the influx of the last few years did, however, not keep up with national trends of rising intake, the panel proposes to raise the number of incoming students. The panel approves of the admission requirements and entry procedures of the programme. In the first year, students are appropriately taught how to study mathematics.

The curriculum of the programme matches the intended learning outcomes. The panel regards the courses to be very strong. The panel considers the curriculum to be of high quality in terms of both breadth and depth. Some courses deserve special mention. The *Inleiding Meetkunde* course is much appreciated by the panel. The *Geschiedenis van de Wiskunde* course is also welcomed by the panel, the course being lectured by an expert in this field. The courses *Wiskunde als Wetenschap* and *Proofs from the Book* allow students to obtain an overview over the mathematics discipline and to study the societal role of mathematics. The panel wants to add some recommendations to improve the curriculum further. The teaching-learning trajectory Analysis should be made more consistent. The fields numerical analysis, modelling and programming ought to be strengthened. The subject of ethics should be reinforced. Discrete mathematics may be given somewhat more attention. The panel finds the research skills training and academic skills training in the curriculum appropriate.

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 proposes to pay attention to the educational capabilities of candidates in the staff members recruitment processes. The panel suggests to intensify teaching assistants training.

The educational concept and the study methods adopted in the programme are regarded by the panel to be effective. The panel welcomes the study guidance by the tutors and the study advisor. The panel considers the material facilities for the programme to be adequate. The panel proposes to balance the study load in the programme, because the study load is quite high and may lead to students dropping out. As the drop-out rates and student success rates of the programme may be regarded to be somewhat disappointing, the panel recommends to monitor these 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 and 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 course examinations to programme intended learning outcomes. The Examinations Board Mathematics monitors the programme examinations' and assessments' quality.

The examination methods in the courses are written examinations, interim tests, in-class written tests, and homework assignments. In the projects, examination methods are written reports and oral presentations. The examinations are aligned with the course goals. In most of the courses, multiple examinations are scheduled. The common distribution of examinations in courses is homework assignments (20 % of the course grade), interim test (30 %) and final written examination (50 %). Homework assignments may constitute no more than 40 % of the course grade to counter effects of any free-riding. In some of the courses, homework assignments have been replaced by in-class written tests. For individual examinations, students have to obtain at least the grade 5.0 out of 10. Teaching assistants mark homework assignments. Written examinations are marked by teaching assistants also, on the basis of answer keys and mostly, but not always, under examiners' supervision.

At the end of the curriculum, students complete the individual Bachelor project. Students are presented a list of supervisors, from which they may choose. In the projects, students are to study and report on mathematical subjects independently. Students come together in the Bachelor project class. In this class, students give presentations about their projects. All students are guided individually by their supervisor, whom they meet frequently. The projects are scheduled strictly. Students who miss the deadline, may not receive higher grades. The projects are assessed by the supervisor and the second reader. The examiners assess the projects on the basis of assessment criteria, such as mathematical contents, project planning, written report and oral presentations in the Bachelor project class. All Bachelor projects are checked for plagiarism. The same applies for second-year project reports. 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. Teaching assistants may be involved in this process. 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 as well as a number of Bachelor projects.

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 course goals. The processes of marking examinations are adequate. Policies to curtail effects of any free-riding are adequate. The panel advises to avoid that teaching assistants review draft examinations and grade examinations without examiners' supervision.

The supervision and assessment processes for Bachelor projects have been well-organised. Students are offered appropriate supervision. The assessment procedures are up to standard, involving two examiners assessing the student's work on the basis or relevant criteria. The panel, however, advises to add more extensive arguments to substantiate the assessments of the Bachelor 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 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 principle of the programme should not efface the intrinsic motivation of students.

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 Bachelor projects of fifteen graduates of the programme with different grades. In the Bachelor projects, students are to demonstrate mastering most of the intended learning outcomes of the programme. Bachelor projects may be research projects or literature studies. The average grade of these projects is 7.7 for the graduates of the last four years. The proportion of students graduating cum laude is 24 % for the last four years. For the majority of the projects, popular abstracts were added.

In the curriculum, some activities are scheduled for students' orientation on follow-up studies and on the labour market. In the *Orientation* courses scheduled in all of the three years of the curriculum, students are informed about choices to be made in the programme and study and career options. Company site visits are part of the Orientation courses.

Programme graduates tend not to enter the labour market. Programme graduates are admitted to a range of master programmes both in mathematics and in other disciplines. The programme graduates proceed to the Master Mathematics (41 %), Master Stochastics and Financial Mathematics (11 %), Master Mathematics and Physics (11 %) or other master programmes (15 %) of University of Amsterdam. Other master programmes are in the domains of computational science, artificial intelligence or logic.

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

The panel is positive about the popular abstracts, added to the Bachelor projects. The panel assesses the Bachelor projects to be up to standard. Although the quality of the projects varies, the quality of the projects is by and large good. The panel supports the grades awarded to the projects. In some cases, the panel would have given somewhat higher grades. No Bachelor projects were found to be unsatisfactory.

The panel is convinced the programme graduates have reached the intended learning outcomes of the programme. Programme graduates have access to master programmes in a wide range of domains. 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 articulate the intended learning outcomes more clearly.
- To raise the number of incoming students.
- To install a curriculum committee for the programme.
- To clarify the teaching-learning trajectory Analysis in the curriculum.
- To strengthen the field of numerical analysis in the curriculum.
- To reinforce the fields of modelling and programming in the curriculum.
- To give the subject of ethics more emphasis in the curriculum.
- To make the educational capabilities of candidates part of the staff members recruitment processes.
- To intensify teaching assistants training.
- To balance the study load in the programme, as the study load is quite high.
- 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 avoid that teaching assistants review draft examinations and marking examinations without examiners' supervision.
- To add more extensive comments and arguments to substantiate the assessments of the Bachelor projects.
- To reinforce the relations with the programme alumni.