academion

Computing Science
Radboud University

www.academion.nl
info@academion.nl

Project code P2409

Contents

Summary

Standard 1. Intended learning outcomes

The bachelor Computing Science aims to provide students with a solid theoretical and practical foundation as well as deep technical skills in computing science. Students are trained to develop, build, design, analyse, and/or improve complex ICT solutions, with consideration for the societal implications of ICT systems. They acquire the knowledge and skills that allow them to quickly adapt to new developments and technologies. The master aims to educate students to become independent computer scientists who can tackle problems, conduct research, and develop solutions and methodologies. Students are trained to think critically and be aware of societal aspects of ICT. Graduates have career perspectives in industry, society, and academia. In their chosen specialization, students focus on one area of computing science in which they acquire deep academic knowledge and thorough skills.

The panel is positive about both programmes' profiles. The bachelor's profile reflects a clear view on societal aspects of computing and includes relevant thematic pathways related to major current trends. The panel is pleased to see that the profile of the master strongly corresponds with the research strengths of the staff. The specializations 'Cyber Security and AI' and 'Mathematical Foundations of Computer Science' are much appreciated as they are distinctive in the Netherlands. The panel considers the intended learning outcomes (ILOs) of both programmes to be well formulated and well aligned with the bachelor's and master's level. The ILOs cover all relevant areas and match with the academic as well as the professional field. The panel does recommend to revise the overarching ILOs for the master that apply to all specializations. More specific elements related to computer science should be included in these in order to ensure that all specializations have discipline-specific ILOs. This is especially relevant in light of the two societal specializations, as their specialization-specific ILOs do not refer to computing science.

The panel concludes that the programmes have various valuable connections to the professional field, as a result of research collaborations, internship partnerships, and lecturers who work in industry part-time. On a more formal level, the 'Commissie Afnemend Veld' (CAV) plays a role in aligning the programmes to the professional field. Members of the CAV are consulted individually at the moment. To consult the CAV in a more structural way at a strategic level, the panel recommends reviving the CAV meetings and regularly consult it about the profiles, ILOs, curricula, and alignment with (developments in) the industry. The panel also recommends looking into the composition of the CAV to make sure that it is a good representation of the broad professional field.

Standard 2. Teaching-learning environment

The panel concludes that the curricula of both programmes are well designed and coherent, covering all relevant topics. The panel appreciates the strong connection between the curricula and the research expertise of the staff. With regard to the bachelor, the alignment with the Association of Computer Machinery (ACM) model curriculum is another strong point. The panel is also positive about the solid mathematical foundation in the bachelor curriculum and about the design of the bachelor thesis course, which greatly supports students in their thesis project. With regard to the master, the panel appreciates the integration of academic and soft skills in various courses throughout the curriculum, including the research internship. The panel also identified several points of improvement for the bachelor curriculum. The panel recommends making the learning pathway for academic writing skills more explicit and visible for both students and staff. The programme should then also monitor if these skills are adequately addressed and assessed in the relevant courses. Furthermore, the panel recommends developing similar learning pathways for other academic and soft skills, including ethics.

Both programmes are taught in English, which, according to the panel, follows logically from the inherent international nature of the field of computer science. The didactic approach in both programmes reflects a fine mixture of theoretical and practical teaching methods. The learning environment is further enhanced by the contributions of industry in the form of guest lectures, company presentations, company excursions, and the possibility to conduct research at an external company. Another positive aspect of the learning environment is the strong student community and the active study association Thalia. Finally, the dedicated education innovator is an asset of the programmes, providing valuable support in the continuous improvement of educational quality and in the development and implementation of educational innovations.

According to the panel, the admission criteria are appropriate. There is room for improvement with regard to the intake procedure of the master, particularly for the specializations ‘Cyber Security’ and ‘Cyber Security and AI’. Some students in these specializations struggle with a knowledge gap, specifically concerning cryptology, even though they met all the entry requirements. The panel recommends looking into this issue and exploring possible solutions. A possible improvement could be to arrange interviews with students before the start of the programme to check their prior knowledge and advise them on possible deficiency repair programmes.

The panel considers the programmes to be feasible within the allocated time. However, more could be done to decrease the considerable study delay. The panel recommends looking into the feasibility and workload of individual courses and the curricula as a whole, to see if there are any structural issues or bottlenecks that may cause study delay, and implementing improvement measures accordingly. The panel is positive about the guidance students receive during the programmes, including the mentor programme in the bachelor. The panel appreciates the accessible attitude of the lecturers, mentors, supervisors, and study advisors. The programmes offer students adequate facilities, including the ‘New Devices Lab’ and a common area that allows for informal contacts between students and staff. Students have easy access to all relevant information through the online learning environment Brightspace. Facilities for students with a disability are appropriate and sufficient.

The teaching staff of the programmes represents all relevant areas of expertise. The lecturers have strong (international) profiles and are didactically qualified. The panel appreciates lecturers’ open and responsive attitude towards students. Another strong aspect is the team spirit among the teaching staff. There is good communication and alignment among lecturers. The panel sees room for improvement with regard to quality assurance. The panel recommends improving the communication between the Programme Committee (PC) and the Education Board, in order to ensure that all points raised by the PC are properly addressed. This may be achieved by the Director of Education attending the PC meetings and by ongoing efforts to re-establish trust and create a constructive culture and dynamic between the PC and the Education Board.

Standard 3. Student assessment

The panel considers the assessment in both programmes to be well designed and aligned with the ILOs. A variety of appropriate assessment methods is used and appropriate measures are taken to improve and ensure the quality of assessment in the programmes, such as the peer-reviews of tests, the use of test matrices, and the use of rubrics or correction models. The panel recommends developing guidelines and policies concerning generative artificial intelligence (GenAI) on programme level. According to the panel, the thesis assessment procedure for both the bachelor and the master is adequate, as the four-eyes principle is applied and grading is done based on clear assessment forms and rubrics. The panel notes that recent measures were taken to improve the quality of the written feedback on the assessment forms and underlines the importance of continuing to monitor and improve this. With regard to the master, the panel recommends aiming for a more varied mix of assessor pairs where possible and organizing more general calibration for assessors, in order to ensure that grading is consistent across assessors. With respect to the master specializations ‘Science in Society’ and ‘Science, Management and Innovation’, the panel recommends implementing the new guidelines proposed by the programme to ensure that theses from these specializations contain sufficient content related to computer science. The panel considers the Examination Board to be independent, competent, in control, and proactive with regard to safeguarding the assessment quality in the programmes.

Standard 4. Achieved learning outcomes

Based on the review of a sample of 15 theses per programme, the panel concludes that the level demonstrated in the theses is appropriate for an academic bachelor’s/master’s programme. The documentation and the interviews indicate that graduates of the bachelor are well equipped to follow a master’s programme or enter the labour market. Graduates of the master are well prepared for and prove to be successful in the professional field.

Score table

The panel assesses the programmes as follows:

B Computing Science	
Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive
M Computing Science	
Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

The assessment panel has reviewed the report and agrees with its contents. On behalf of the panel,

Prof. dr. S. (Sjouke) Mauw, [Chair] Anne-Lise Kamphuis MSc, [Secretary]
Date: 5 February 2026

Introduction

Procedure

Assessment

On 30 and 31 October 2025, the bachelor's and master's programmes Computing Science of Radboud University were assessed by an independent peer review panel as part of the cluster assessment. The assessment cluster consisted of 25 programmes, offered by the institutions Open Universiteit, Leiden University, University of Groningen, Utrecht University, Radboud University, Eindhoven University of Technology, Delft University of Technology, Vrije Universiteit Amsterdam, University of Amsterdam, and University of Twente. The assessment followed the procedure and standards of the NVAO Assessment Framework for the Higher Education Accreditation System of the Netherlands (April 2024).

Quality assurance agency Academion coordinated the assessment upon request of the Computing Science cluster. Peter Hildering acted as coordinator in the cluster assessment and Anne-Lise Kamphuis acted as secretary for the assessment of the programmes of Radboud University. They have been certified and registered by the NVAO.

Panel composition

Academion composed the peer review panel in cooperation with the institutions and taking into account the expertise and independence of the members. In order to strengthen the mutual consistency between the assessment panels within the cluster, the coordinator from Academion ensured joint instruction for the panel members and a comparable assessment method for all site visits. This consistency was also a point of attention in all concluding panel meetings during the site visits. Finally, overlap in assessment panels of the various site visits in the cluster further strengthened the consistency. The composition of the panels was designed in such a way that at least one panel member also participated in another assessment panel in the cluster.

On 30 April 2025 the NVAO approved the composition of the panel. The coordinator instructed the panel chairs on their role in the site visit according to the Panel chair profile (NVAO 2016) on 9 December 2024.

Preparation

The programmes composed a site visit schedule in consultation with the coordinator (see appendix 3). The programmes selected representative partners for the various interviews. They also determined that the development dialogue would be made part of the site visit. A separate development report was made by the secretary based on this dialogue.

The programmes provided the coordinator with a list of graduates over the period 2024-2025. In consultation with the coordinator, the panel chair selected 15 theses per programme. They took the diversity of final grades and examiners into account, as well as the various specializations. For the master's programme, the panel selected 5 theses from the specialization 'Cyber Security', 4 from 'Data Science', 2 each from 'Mathematical Foundations of Computer Science' and 'Software Science', and 1 each from the societal specializations 'Science, Management and Innovation' and 'Science in Society'. This selection reflected the number of graduates in each particular specialization proportionally. The specialization 'Cyber Security and Artificial Intelligence' did not yet have any graduates at the time of the thesis selection due to its recent start.

Prior to the site visit, the programmes provided the panel with the theses and the accompanying assessment forms. They also provided the panel with the information files and additional materials (see appendix 4).

The panel members studied the information and sent their findings to the secretary. The secretary collected the panel's questions and remarks in a document and shared this with the panel members. In a preliminary meeting, the panel discussed the initial findings on the information file and the theses, as well as the division of tasks during the site visit. The panel was also informed on the assessment frameworks, the working method and the planning of the site visits and reports.

Site visit

During the site visit, the panel interviewed various programme representatives (see appendix 3). The panel also offered students and staff members an opportunity for confidential discussion during a consultation hour. No consultation was requested. The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the preliminary findings, general observations of the panel and suggestions for development themes.

Report

The secretary wrote a draft report based on the panel's findings and submitted it to the coordinator for peer assessment. Subsequently, the secretary sent the report to the panel for feedback. After processing this feedback, the secretary sent the draft report to the programmes in order to have it checked for factual irregularities. The secretary discussed the ensuing comments with the panel chair and changes were implemented accordingly. The panel then finalized the report, and the coordinator sent it to Radboud University.

Panel

The panel assessing the B and M Computing Sciences consisted of the following members:

- Prof. dr. S. (Sjouke) Mauw, professor in Security and Trust of Software Systems at the University of Luxembourg [Chair]
- Prof. dr. ing. N. (Norbert) Fuhr, professor Computer Science at the Universität Duisburg-Essen
- Prof. dr. M. (Marieke) Huisman, professor Software Reliability at the Faculty Electrical Engineering, Mathematics and Computing Science at the Twente University
- I. (Imane) el Caïdi BSc, master student Computer Science (track Algorithmic Design and Analysis & Operations Research) at the Utrecht University [Student-member]

Each panel member, the panel secretary and the programmes have filled out the Statement of Impartiality and non-disclosure agreement, as required by the NVAO. They can confirm that the assessment was carried out in complete independence.

Information on the programmes

Name of the institution:	Radboud University
Address:	Houtlaan 4, 6525 XZ Nijmegen
Website:	www.ru.nl
BRIN-number:	21PM
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive

Programme name:	Computing Science
ISAT number:	59326
Orientation of the programme:	Academic
Level of the programme:	Bachelor (NLQF 6)
Number of credits:	180 EC
Language of instruction:	English
Professional requirements:	no
Location:	Nijmegen
Mode(s) of study:	Fulltime
Assessment group:	Informatica
Awarded degree:	BSc
Submission date NVAO:	1 May 2026

Programme name:	Computing Science
ISAT number:	60364
Orientation of the programme:	Academic
Level of the programme:	Master (NLQF7)
Number of credits:	120 EC
Language of instruction:	English
Professional requirements:	no
Specializations or tracks:	Data Science Cyber Security Cyber Security and Artificial Intelligence Software Science Mathematical Foundations of Computer Science Science, Management and Innovation Science in Society
Location:	Nijmegen
Mode(s) of study:	Fulltime
Assessment group:	Informatica
Awarded degree:	MSc
Submission date NVAO:	1 May 2026

Description of the assessment

Organization

The bachelor and master programmes Computing Science are offered by the Faculty of Science of the Radboud University. Radboud University consists of seven faculties, offering 38 bachelor programmes and 62 master programmes. Over 23,000 students are enrolled at the university. The Faculty of Science offers seven bachelor programmes and nine master programmes in the domains of information and computing science, mathematics, physics, chemistry, biology, and molecular sciences. The bachelor and master Computing Science are embedded in the Educational Institute for Computing and Information Sciences (EICIS), which is closely related to the research Institute for Computing and Information Sciences (ICIS). The vast majority of the lecturers active in the Computing Science programmes are members of ICIS, and the specializations of the master correspond with the research specializations of the institute. The bachelor Computing Science is an English-taught BSc programme with an intake of about 150 students per year. The master Computing Science is an English-taught MSc programme with a yearly inflow of around 100 students.

Recommendations previous panel

The previous accreditation of the bachelor and master Computing Science dates from 2019. The panel concluded that both programmes met all four standards, resulting in positive assessments. The panel gave a number of recommendations. In response to these recommendations, the programmes implemented several improvements, including a revision of academic writing skills in the curricula, strengthening communication to bachelor students about opportunities to study abroad, the systematic collection of alumni information, improving the thesis assessment procedures, and strengthening the position of the Examination Board (EB). The panel examined the programmes' response to the recommendations and concludes that they have been seriously acted upon by the programme. The panel is generally content with the improvement measures taken. For a couple of recommendations, the programmes are still in the process of further improvement. These issues will be addressed further on in this report.

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

Profile and vision

<u>Bachelor</u>

The bachelor Computing Science aims to provide students with a solid theoretical and practical foundation as well as deep technical skills in computing science. Students are trained to develop, build, design, analyse, and/or improve complex ICT solutions, with consideration for the societal implications of ICT systems. They acquire the knowledge and skills that allow them to quickly adapt to new developments and technologies. The programme does not offer formal specializations but it does offer three thematic pathways (Software Science, Data Science, and Cyber Security), from which students choose at least two. The Software Science theme focuses on software theory and the application of new devices. The thematic pathway Data Science addresses data mining techniques, machine learning, and big data. In the Cyber Security theme, the technical and societal aspects of security are covered.

The panel is positive about the profile of the bachelor. According to the panel, it reflects a clear view on and attention for the societal aspects computing, such as sustainability and privacy. The three themes are relevant as they all represent major current trends in computing science. They allow students to explore various areas in computing science according to their own interests and ambitions and to orient themselves on possible master programmes. The extensive coverage of the topic of security in the theme Cyber Security is a distinctive feature of this bachelor, according to the panel.

Master
The master aims to educate students to become independent computer scientists who can tackle problems, conduct research, and develop solutions and methodologies. Students are trained to think critically and be aware of societal aspects of ICT. Graduates have career perspectives in industry, society, and academia. In their specialization, students focus on one area of computing science in which they acquire deep academic knowledge and thorough skills. The programme offers seven specializations. Five of these specializations relate to various specific areas in computing science: 'Data Science', 'Cyber Security', 'Cyber Security and Artificial Intelligence', 'Software Science' and 'Mathematical Foundations of Computer Science'. These five specializations are closely linked to the research sections in ICIS. The specialization 'Data Science' focuses mainly on artificial intelligence (AI) and information retrieval. 'Cyber Security' covers both the organizational and technical aspects of cyber security. It addresses topics such as cryptology, software, networking, security protocols, data protection, and privacy. The specialization 'Cyber Security and AI' focuses on the intersection of AI and cybersecurity, spanning topics such as network and software security, applied cryptography, security of AI, privacy, and IT-related law. This specialization is unique in the Netherlands. 'Software Science' addresses the construction, implementation, testing, validation, and verification of software, with an emphasis on functional programming and model-based system development and analysis. Finally, 'Mathematical Foundations of Computer Science' covers topics related to the formal meaning and mathematical modelling of programs and programming languages, the behaviour of systems, algorithms, programs, and compilers, and the analysis of computer artefacts.

Two specializations of the master are societal specializations: 'Science, Management and Innovation' (SMI) and 'Science in Society' (SiS). These are faculty-wide specializations that students from a wide range of master's programmes can participate in. Students follow one year of education in their own discipline, and one year of specialization-specific education. Both SMI and SiS are interdisciplinary and focus on the intersection of the student's own discipline and societal themes. SMI concentrates on entrepreneurship, management, and innovation, while SiS concentrates on science communication. The two societal specializations are not often chosen by Computing Science students. In the past five years, only 9 students chose one of these specializations.

According to the panel, the profile of the master is well defined. It was clearly developed from the perspective of the research strengths of the staff. This close relation between the programme and research is a strength of the programme, according to the panel. The panel specifically appreciates the specializations 'Cyber Security and AI' and 'Mathematical Foundations of Computer Science' as they are distinctive in the Netherlands. The 'Cyber Security and AI' specialization also reflects a forward-looking approach and ability to adapt to developments in the (future) professional field. The panel values the two societal specializations as they allow students to bridge the gap between science and society.

Intended learning outcomes
The intended learning outcomes (ILOs) of the programmes consist of general ILOs, defined at faculty level, and programme-specific ILOs (see appendix 1 for an overview of the ILOs). At faculty level, three general ILOs were defined for bachelor programmes and four ILOs for master programmes. These ILOs are related to the

acquisition of knowledge, understanding, and skills in the relevant field of study, the development of academic competences, and the preparation for a career. For the bachelor programmes, preparation for further study is also included in the general ILOs. For the master programmes, the general ILOs also include the deepening of qualifications regarding independent academic research.

On top of the general ILOs, programme-specific ILOs apply. For the bachelor, 23 programme-specific ILOs were formulated in the categories (system) development, research, communication, reflection, and core. Additional ILOs are described for the three themes and for students who pursue a double diploma (both 'Mathematics' and 'Computing Science'). For the master, four ILOs were defined for all students, regardless of their specialization. Additional ILOs are described for each of the seven specializations. In the documentation, the ILOs of both programmes are related to the Dublin descriptors.

According to the panel, the ILOs of both programmes are appropriate for the academic bachelor's/master's level as described in the Dublin descriptors. They thereby also reflect the corresponding level 6 (bachelor) and 7 (master) of the Dutch qualification framework NLQF. The ILOs cover all relevant areas and are aligned with international standards, the programmes' visions, and the expectations of the academic and professional field. The panel sees room for improvement with regard to the overarching ILOs of the master, which apply to students from all specializations. These ILOs are formulated in very general terms without much reference to (contents from) computing science. In the case of the five computing science specializations, more specific ILOs related to computing science are described in the additional ILOs per specialization. The additional ILOs for the two societal specializations, however, make no reference to computing science. Because of this, students from the societal specializations could, in theory, achieve all applicable ILOs of the master without much knowledge, insights, and skills in computing science. Even though this is not the case in practice, the panel recommends revising the overarching ILOs in order to address this design flaw. More elements specific for computing science should be included to ensure that all specializations have discipline-specific ILOs.

Professional field
According to the panel, both programmes have valuable connections with the professional field that help align the programmes to the needs of and developments in the industry. There are various research collaborations of staff members with industry partners, some of whom also regularly host internships and/or employ graduates. Several lecturers have part-time jobs in industry besides their teaching appointment. Also, professionals from the computing science field may contribute to the programmes by giving guest lectures. Besides these connections with industry, there is a professional field committee: 'Commissie Afnemend Veld' (CAV), consisting of professionals from various companies. The CAV is consulted about the needs and expectations of the current labour market in order to align the programmes and ILOs with the professional field. The panel learnt from the interviews that the CAV used to meet regularly as a committee before the COVID pandemic. During the pandemic, the committee could not meet and since then, it has proven very difficult to rebuild the CAV. In the interviews, the programme explained that it is making an effort to revive the CAV meetings. In the meantime, the programme management meets with CAV members individually once a year on average. The panel values these individual meetings and encourages the programmes to continue them. However, the panel feels that it is important to restart the CAV meetings in order to allow for structural alignment with the professional field at a strategic level. The CAV should be regularly consulted about the profiles, ILOs, curricula, and alignment with (developments in) the industry. The panel also recommends looking into the composition of the CAV to make sure that it is a good representation of the broad professional field.

Considerations

The panel is positive about both programmes' profiles. The bachelor's profile reflects a clear view on societal aspects of computing and includes relevant thematic pathways related to major current trends. The panel is pleased to see that the profile of the master strongly corresponds with the research strengths of the staff. The specializations 'Cyber Security and AI' and 'Mathematical Foundations of Computer Science' are much appreciated as they are distinctive in the Netherlands. The panel considers the ILOs of both programmes to be well formulated and well aligned with the bachelor's and master's level. The ILOs cover all relevant areas and match with the academic as well as the professional field. The panel does recommend to revise the overarching ILOs for the master that apply to all specializations. More specific elements related to computer science should be included in these in order to ensure that all specializations have discipline-specific ILOs. This is especially relevant in light of the two societal specializations, as their specialization-specific ILOs do not refer to computing science.

The panel concludes that the programmes have various valuable connections to the professional field, as a result of research collaborations, internship partnerships, and lecturers who work in industry part-time. On a more formal level, the CAV plays a role in aligning the programmes to the professional field. Members of the CAV are consulted individually at the moment. To consult the CAV in a more structural way at a strategic level, the panel recommends reviving the CAV meetings and regularly consult it about the profiles, ILOs, curricula, and alignment with (developments in) the industry. The panel also recommends looking into the composition of the CAV to make sure that it is a good representation of the broad professional field.

Conclusion

The panel concludes that the bachelor's and master's programme Computing Science meet standard 1.

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

Curriculum

<u>Bachelor</u>

The bachelor consists of 180 EC and is offered as a three-year fulltime programme (see appendix 2 for an overview of the curriculum). The curriculum was designed in alignment with the model curriculum of the Association of Computer Machinery (ACM). The documentation shows how the knowledge areas and expected characteristics of bachelor graduates defined by ACM are covered in the curriculum. The relation between the courses and the ILOs is demonstrated in a matrix. The first year of the bachelor consists of 15 mandatory courses (60 EC) covering a broad range of topics from computing science. The second and third year include additional mandatory courses (54 EC in total). Besides this, students follow two out of three themes (Software Science, Data Science, and Cyber Security). Each theme consists of two or three course (12 EC in total). The curriculum also includes 12 EC for free electives and a 15 EC minor, which can be followed at the Radboud University or another university in the Netherlands or abroad. Throughout the programme, students work on a portfolio (3 EC), which is assessed in the third year in the course 'Reflection and Vocational Orientation'. For this portfolio, students attend mentor meetings, bachelor thesis presentations, and lunch lectures by guest speakers, and participate in company excursions. They subsequently write a selfreflection essay. In the final semester, students write their bachelor thesis (12 EC), which is an individual research project, supervised by an ICIS staff member. The bachelor thesis is organized as a course with mandatory plenary meetings, flash talks and writing sessions, in which students write together and give peer feedback on each other's theses. A lecturer is present in these sessions to answer questions.

Master

The master consists of 120 EC and is offered as a two-year fulltime programme (see appendix 2 for an overview of the curriculum). Below, the curriculum for the five computing science specializations is described. The curricula for the societal specializations are not included in this assessment, as they were already assessed in the visitation of the master Medical Biology in 2021. The panel refers to the report of that accreditation for the assessment of these specializations. The curricula of SMI and SiS cover the second year of the programme. Besides the courses related to SMI or SiS, students in these specializations must complete the mandatory course packages of the specialization 'Data Science' or 'Software Science', plus an additional 6 EC (SMI) or 3 EC (SiS) of computing science courses. In this way, it is ensured that students in these specializations achieve all ILOs of the Computing Science programme.

The five computing science specializations share the following mandatory courses: 'Philosophy and Ethics for Computing and Information Science' (3 EC), a research internship (15 EC), and the master thesis (30 EC). In addition, each specialization offers a (specialization-specific) research seminar (6 EC). Besides these courses, each specialization includes a number of (specialization-specific) mandatory courses (12-24 EC), specialization electives (24-30 EC, restricted choice), master electives (12-24 EC, students can choose courses from other specializations as well), and free electives (6 EC). For the research internship, students do an internship at an external company or a research department (internal or external). During the internship, which is scheduled at the beginning of the second year, they work on an individual research project and go through the entire research process, including reporting and presenting it. As they are still learning to do research, students collaborate with others more and/or receive more guidance than during the master thesis project. For the master thesis, students carry out a research project independently, supervised by a staff member. Students have the freedom to pursue a topic of their own interest within the range of their specialization. The research project can be carried out at an external company or in one of the research departments.

Both programmes

According to the panel, the curricula of both programmes are well designed and coherent, covering all relevant topics. The strong connection between the curricula and the research expertise of the staff, which is particularly evident in the master specializations, is an added value of the programmes that creates an attractive learning environment for students. The panel appreciates the steps taken to increase attention for the topic of sustainability in the programmes. As of academic year 2024-2025, an elective on this topic (Sustainability & IT) was implemented in the bachelor. For the master, the new restricted choice elective 'Green Software' (in the specializations 'Software Science' and 'Data Science') was introduced in 2025-2026.

With respect to the bachelor, the alignment with the body of knowledge and skills of ACM ensures that all relevant areas of computer science are covered and that the curriculum fits with the international academic and professional field. The panel especially appreciates the solid mathematical foundation evident in the bachelor curriculum, which is a strength of the programme. The panel is also pleased with the design of the bachelor thesis course. The mandatory writing sessions including peer feedback are valuable ingredients of this course that greatly support students in their thesis project. From the interviews, it is clear that students much appreciate the way that the bachelor thesis course is organized, as it helps them make progress and allows them to get peer feedback on a text before handing it in with the supervisor.

The panel thinks that further improvements can be made regarding the attention for academic and soft skills throughout the bachelor curriculum. There used to be a separate course on academic writing in the third year. This course was discontinued, and instead, academic writing was integrated as a learning pathway into six existing courses throughout the curriculum. This new setup was implemented in phases from the academic year 2022-2023 to 2024-2025. The panel learnt from the interviews that further efforts are needed to strengthen this learning pathway, to clarify it to both students and staff, and to make sure that academic writing skills are effectively addressed and assessed in these courses. Therefore, the panel recommends making the learning pathway for academic writing skills more visible for students and staff and making explicit where it is addressed and assessed. This should then also be monitored. Related to this, the panel recommends developing similar learning pathways for other academic and soft skills, including ethics. This may be combined with the development of the learning pathway for personal and professional development (PPD), which will be implemented as of 2026-2027 as part of a faculty-wide policy.

With respect to the master curriculum, the panel is positive about the attention for academic and soft skills. From the documentation and the interview with students, the panel learnt that academic and soft skills , such as writing and presenting, are addressed frequently in various courses throughout the curriculum. The mandatory research internship further allows students to develop their academic and soft skills in an academic or professional environment.

With regard to both programmes in general, the panel learnt from the interviews that the honours programme as well as some projects with secondary schools were recently discontinued, due to budget cuts. The panel regrets the loss of these projects and thinks that the impact is significant. At the same time, the panel understands that these issues are outside the programmes' span of control. The panel expresses its support for the programmes, hoping that these activities may be revived in the future.

Learning environment
Both programmes highly value the combination of theory and hands-on practice, with special attention to a solution-driven approach to learning and the construction of (tangible) professional products, such as software and demos. The programmes use a variety of teaching formats, including lectures, seminars, lab sessions, response sessions, tutorials, and (research) project work. In the interviews, students indicated that they are positive about the teaching formats. They confirmed that there are many practical assignments and hands-on learning opportunities in the courses, which they appreciate very much.

The panel concludes that the didactic approach of the programmes reflects a fine mixture of theoretical and practical teaching methods that support students in their learning process. The panel also appreciates the input from the industry that is built into the programmes, such as guest lectures, company presentations, and company excursions. In the master, the research internship allows students to gain further experience in a professional environment. Moreover, for both the bachelor and the master thesis, students can choose to conduct their research at an external company. The learning environment also benefits greatly from the strong student community and the active study association Thalia. Thalia organizes many (social) activities, including a bachelor thesis market where companies present themselves. Finally, the panel is very pleased to see that EICIS has a dedicated education innovator as of 2024, whose role is to support the educational institute in continuously improving the quality of education and implementing educational innovations. The interviews show that lecturers are very happy with the contributions of the education innovator. According to the panel, this is an asset of the programmes, which enhances the quality of the education and learning environment.

Language of instruction
Both programmes are taught in English and use an English name. According to the panel, the choice for English as the language of instruction is justified as it follows logically from the inherent international nature of the field of computer science. Students are educated for professional and academic environments that are international and in which English is the common language.

Admission
The admission criteria for both programmes are laid down in the Education and Examination Regulations (EER). The Admissions Office decides on admission. International applications are always assessed by the Admissions Officer. To be admitted to the bachelor, applicants need to have a vwo-diploma including mathematics B (or the international equivalent thereof), or a propaedeutic diploma from a 'hbo' bachelor programme supplemented with a mathematics certificate (equivalent to vwo mathematics B) and proof of sufficient English proficiency. Applicants of 21 years or older can take an entrance examination (colloquium doctum) to be admitted. For the master, an academic bachelor's degree in (technical) computing science, or equivalent thereof, is required. The specialization Data Science is also admissible to students with a bachelor's degree in Artificial Intelligence and the specialization 'Mathematical Foundations of Computer Science' is also admissible to students with a bachelor's degree in Mathematics. For students with a bachelor's degree from a university of applied science (hbo), completing a premaster (30 EC) may grant access to the master. Both programmes have a generic requirement with regard to the level of English. Applicants have to demonstrate their English proficiency by means of a diploma or certificate that meets the requirements stated in the EER and on the university's website.

The panel agrees with the admission criteria for both programmes and considers them appropriate. The interviews do point out that some master students who meet all the admissions requirements, still have a knowledge gap, especially with regard to cryptology. This seems to apply particularly to students in the specializations 'Cyber Security' and 'Cyber Security and AI', not only to international students but also to students who did their bachelor at another university in the Netherlands. The panel recommends looking into this issue and exploring possible solutions. The programme may consider arranging interviews with students before the start of the programme to check their prior knowledge and advise them on possible deficiency repair programmes. The programme indicated that it already has (online) teaching materials available for students who need to brush up their knowledge. By proactively checking prior knowledge beforehand, students are given the opportunity to repair deficiencies before the start of the programme.

Feasibility
In the past few years, around 16% of the bachelor students finished the programme within three years, and about a third of the students finished within four years. In the master, about 13% finished within two years, and about half of the students within three years. The panel notes that there is considerable study delay in both the bachelor and the master. According to the programmes, a substantial part of the study delay in both programmes is caused by factors outside the influence of the programmes, such as personal circumstances or students who practically study part-time because of a side job. The interviews with students show that their experience is that the programmes are intensive but feasible within the allocated time. In the bachelor, several measures were implemented in recent years to increase the feasibility, such as additional tutorial sessions for students with no prior or limited programming experience and re-scheduling courses in the second year to better balance the study load. These measures are expected to affect the study success figures in the coming years. Besides these recent measures in the bachelor, and despite the influence of external factors on study delay (such as side jobs), the panel thinks that more can be done to decrease the high study delay in the programmes. The panel recommends investigating the curricula to see if there are any structural issues or bottlenecks that cause study delay. This includes monitoring the workload

of courses. Students indicated that the workload of courses does not always reflect the number of EC, as some courses require much more work than other courses with the same number of credits. The panel thinks it may be useful to look into this matter to gain further insights into the feasibility of individual courses and the programmes as a whole.

Guidance

In the courses, students are primarily supervised and guided by the lecturers. In the bachelor, practical assistance in seminars is often provided by teaching assistants (students, PhD students, or post-docs). During the thesis project in the bachelor and master, students are guided by a thesis supervisor, who must be an ICIS staff member. Guidance during the master research internship is provided by a supervisor from the staff. Students may have an additional daily supervisor at the research department or external company.

For overall guidance in both the bachelor and master, study advisors are available for students with questions or issues. All first-year students are invited for a meeting with the study advisor at least once. Study advisors also pro-actively contact students when they are concerned about study progress. In such cases, the study advisor will meet with the student to discuss the causes of the delay and possible ways to support and help the student. Study advisors can refer students to more specialized support, such as the student psychologist, student counsellor, or career officer. Additionally, in the bachelor, a mentor programme has been implemented for the first year. Students are placed in small groups of 5-6 students that are assigned to a mentor (a lecturer in the programme). There are six mentor meetings throughout the first year, led by the mentor, in which issues concerning the study are discussed, such as students' experiences in the study so far, the study load, study skills, and study progress and delay. Mentors may refer students to the study advisors when needed.

The panel is positive about student guidance in both programmes. This was confirmed by the students, who indicated that they are satisfied with the guidance and support they receive. Lecturers, mentors, supervisors, and study advisors are all very approachable, according to students. The panel appreciates the mentor programme in the bachelor. From the interviews, the panel learnt that both students and lecturers who act as mentors are positive about it. It is especially valuable for international students, who tend to have a smaller network and have to make a bigger effort to integrate. Besides providing first-year students with extra guidance, the mentor programme also allows the programme to be informed of possible issues in courses or the curriculum.

Facilities

The programmes have their home base on the ground floor of the Mercator 1 building: the offices of staff are located here, as well as work and study spaces for students, and the common room of the study association Thalia. This area allows for frequent informal contacts between students and staff and functions as a hub for social activities. Students indicated that they are very positive about this space and its facilities. The programmes also have a dedicated lecture room/lab space, called the 'New Devices Lab', which facilitates students to build devices combining hardware and software. On the online learning environment Brightspace, students can find detailed information on courses. Students indicated that they are positive about information provision. They also mentioned that it is easy to get in touch with staff members when there are questions. The panel concludes that the facilities and information provision are adequate.

For students with a functional impairment, special arrangements can be made. The study advisors are the first point of contact for these matters. They provide information about studying with an impairment and coordinate the necessary actions in the process for special arrangements. The panel concludes that facilities for students with a disability are appropriate and sufficient.

Teaching staff

The bachelor is taught by a teaching team of over forty lecturers and the master by a team of over fifty lecturers. Many lecturers teach both in the bachelor and master and all lecturers are connected to the research department ICIS. Nearly all lecturers have a University Teaching Qualification (UTQ) or are in the process of obtaining one. The panel is positive about the teaching staff. The lecturers have strong (international) profiles and are didactically qualified. The teams represent all relevant areas of expertise and are well embedded in respected research sections. The panel appreciates the open and responsive attitude of lecturers towards students. Students indicated that lecturers are easily approachable. For example, they can simply walk into their offices if they have questions. The panel is also pleased with the team spirit demonstrated in the interviews. There is a strong community feeling among the lecturers, which extends across specializations. Furthermore, there is good communication and alignment among lecturers. For instance, lecturers regularly align when their courses build on each other. Partly, this takes place at an informal level. On a more formal level, alignment is achieved during department meetings, in which the educational programme is regularly discussed, and during the annual teacher's days, which are organized for the entire teaching staff. At the most recent teacher's day, all bachelor course coordinators presented their course, which facilitated alignment and provided everyone with valuable insights into the curriculum. Teacher's days are also used to share experiences with regard to educational innovations. Finally, the panel is satisfied with the English proficiency of the teaching staff. This was confirmed by the students, who indicated in the student chapter that the language skills of lecturers are sufficient.

The panel learnt that, due to budget cuts, the faculty imposed a hiring freeze. The panel understands that this may cause some unrest among the staff. From the interviews, it seems that the hiring freeze has not caused major problems so far, but, according to the panel, it may become problematic in the future if the teaching staff further decreases in size. The panel underlines the importance of providing sufficient support to the teaching staff and of exploring possibilities to hire additional staff where and when possible.

In many bachelor courses, teaching assistants (students, PhD students, or post-docs) are employed to support the lecturers. For instance, teaching assistants may provide guidance and feedback to student groups during assignments. All teaching assistants receive a mandatory training programme prior to their work. The panel is positive about the use of teaching assistants, as it provides easily accessible support for students. Students mentioned that they appreciate these peer contacts and often find it easier to ask help from a teaching assistant than from a lecturer. They also appreciate the opportunity to work as a teaching assistant.

Quality assurance

There is a faculty-wide procedure with regard to quality assurance. All courses are evaluated by the students by means of a survey. The Programme Committee (PC) discusses these evaluations after each quarter, along with other input that it received from students or staff. The PC reports to the Education Board and advises on required improvement measures based on its evaluations. From the documentation and the interviews, it became clear that the communication between the PC and the Education Board has not been optimal in recent years. The PC indicated that some of the points it raised have not been adequately addressed by the Education Board. In some courses, the same issues arose every year.

The panel concludes that there seems to be too much distance between the PC and the Education Board. Due to the rather complex system with a PC as well as an Education Board, some points raised get lost, resulting in several persisting issues. The panel does note that these persisting issues only apply to a small number of courses, while students are content about the majority of courses. However, the panel thinks that the quality assurance cycle should be improved. It recommends improving communication between the PC and the Education Board. The Director of Education, who chairs the Education Board, already expressed the intention to attend the PC meetings, which, according to the panel, is an essential step in the process of improving communication. The panel agrees with the observation of the programmes that ongoing efforts need to be made to re-establish trust and create a constructive culture and dynamic between the PC and the Education Board. Besides more effective communication between the PC and the Education Board, a more formal connection with the study association may help to improve the quality assurance. The study association has a low-threshold connection with students and, as such, receives ample valuable input and feedback from students. From the interviews, it became clear that Thalia's Commissioner of Education has informal contacts with the Director of Education, in which some of this feedback can be shared, but the panel thinks that this could be formalized in order to strengthen its effectiveness. Another suggestion from the panel is to use more intensive evaluation methods in courses that continue to receive negative feedback, such as intermediate evaluation (during the course) and group interviews with students. These may provide the programmes with better insights into the problems and ideas for possible solutions.

Considerations

The panel concludes that the curricula of both programmes are well designed and coherent, covering all relevant topics. The panel appreciates the strong connection between the curricula and the research expertise of the staff. With regard to the bachelor, the alignment with the ACM model curriculum is another strong point. The panel is also positive about the solid mathematical foundation in the bachelor curriculum and about the design of the bachelor thesis course, which greatly supports students in their thesis project. With regard to the master, the panel appreciates the integration of academic and soft skills in various courses throughout the curriculum, including the research internship. The panel also identified several points of improvement for the bachelor curriculum. The panel recommends making the learning pathway for academic writing skills more explicit and visible for both students and staff. The programme should then also monitor if these skills are adequately addressed and assessed in the relevant courses. Furthermore, the panel recommends developing similar learning pathways for other academic and soft skills, including ethics.

Both programmes are taught in English, which, according to the panel, follows logically from the inherent international nature of the field of computer science. The didactic approach in both programmes reflects a fine mixture of theoretical and practical teaching methods. The learning environment is further enhanced by the contributions of industry in the form of guest lectures, company presentations, company excursions, and the possibility to conduct research at an external company. Another positive aspect of the learning environment is the strong student community and the active study association Thalia. Finally, the dedicated education innovator is an asset of the programmes, providing valuable support in the continuous improvement of educational quality and in the development and implementation of educational innovations.

According to the panel, the admission criteria are appropriate. There is room for improvement with regard to the intake procedure of the master, particularly for the specializations 'Cyber Security' and 'Cyber Security and AI'. Some students in these specializations struggle with a knowledge gap, specifically concerning cryptology, even though they met all the entry requirements. The panel recommends looking into this issue and exploring possible solutions. A possible improvement could be to arrange interviews with students before the start of the programme to check their prior knowledge and advise them on possible deficiency repair programmes.

The panel considers the programmes to be feasible within the allocated time. However, more could be done to decrease the considerable study delay. The panel recommends looking into the feasibility and workload of individual courses and the curricula as a whole, to see if there are any structural issues or bottlenecks that may cause study delay, and implementing improvement measures accordingly. The panel is positive about the guidance students receive during the programmes, including the mentor programme in the bachelor. The panel appreciates the accessible attitude of the lecturers, mentors, supervisors, and study advisors. The programmes offer students adequate facilities, including the 'New Devices Lab' and a common area that allows for informal contacts between students and staff. Students have easy access to all relevant information through the online learning environment Brightspace. Facilities for students with a disability are appropriate and sufficient.

The teaching staff of the programmes represents all relevant areas of expertise. The lecturers have strong (international) profiles and are didactically qualified. The panel appreciates lecturers' open and responsive attitude towards students. Another strong aspect is the team spirit among the teaching staff. There is good communication and alignment among lecturers. The panel sees room for improvement with regard to quality assurance. The panel recommends improving the communication between the PC and the Education Board, in order to ensure that all points raised by the PC are properly addressed. This may be achieved by the Director of Education attending the PC meetings and by ongoing efforts to re-establish trust and create a constructive culture and dynamic between the PC and the Education Board.

Conclusion

The panel concludes that the bachelor's and master's programme Computing Science meet standard 2.

Standard 3. Student assessment

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

Findings

Assessment system

Assessment in the programmes is based on the faculty's assessment policy and procedures and specified in the programmes' test matrices. The test matrix shows which ILOs are assessed in each course. For each course, it also describes the learning goals and assessment methods. The matrices show that each ILO is assessed in multiple courses, enabling students to gradually achieve the final exit level in all areas. The panel considers the assessment in both programmes to be well designed and aligned with the ILOs. A variety of appropriate assessment methods is applied, including written exams, individual (homework) assignments, group projects, presentations, and reports. There is a good balance between individual and group assessments. Moreover, the interviews showed that group assessment is well set up, with sufficient attention for individual contributions and the prevention of freeriding.

The panel is pleased to see that the four-eyes principle is applied when developing a test. Each test needs to be peer reviewed prior to being administered. For each course, a test matrix is made which demonstrates the relation between the course's learning goals and the test. Grading should be done based on rubrics or a correction model. In the case of oral exams, a second examiner must be present, or a recording must be made. The panel concludes that appropriate measures are taken to improve and ensure the quality of assessment in the programmes.

In general, students are content about assessment in the programmes. Bachelor students did bring up one concern about the assessment of mathematics. In some cases, mathematics is assessed by means of a multiple choice test, which, according to the students, is not appropriate since partially correct computations still result in an incorrect final answer. From the interviews, the panel learnt that there are no guidelines for examiners about multiple choice exams at the moment. Mathematics lecturers explained that they limit multiple choice questions and design them in such a way that miscalculations cannot ruin the entire answer. Students also mentioned that, in some multiple choice exams, they can state their calculations in a box, allowing the lecturer to still award part of the points even if the final answer is incorrect. The panel encourages the programme to look into this issue in consultation with the EB, and to consider developing some guidelines for examiners.

With regard to the impact of generative AI (GenAI) on assessment, the panel sees that the programmes have already put some measures in place to address it. At the moment, these depend mostly on the lecturer. Some lecturers provide detailed instructions on which use of GenAI is and is not allowed, while in other courses this is less explicitly described. The panel thinks that the guidelines with regard to GenAI need further development and coordination at programme level. Therefore, the panel recommends developing such guidelines and policies for the programmes as a whole. Moreover, it encourages the programmes to think about the impact of GenAI on the programmes at a strategic level, beyond assessment only.

Thesis assessment
In both the bachelor and the master, the thesis is considered the final student project, in which students demonstrate that they have achieved the ILOs. Assessment of both the bachelor and master thesis is based on the thesis itself and a presentation. The theses are always assessed by the supervisor and a second assessor, based on an assessment form with rubrics. The first and second assessor both grade the thesis independently and then discuss with each other in order to arrive at a final grade. According to the panel, the thesis assessment procedure is well set up in both the bachelor and the master. The panel is pleased to see that the four-eyes principle is applied. The assessment forms and rubrics are clear and extensive. In preparation for the site visit, the panel reviewed a sample of 15 theses from each programme, including the completed assessment forms. The panel agrees with the grades awarded to the theses included in the samples. The panel did notice that the written feedback to substantiate the grades on the assessment forms is of varying quality. The programmes recently improved the forms and made written feedback mandatory, in response to a recommendation from the previous accreditation's panel. The panel recognizes that this measure has improved the written feedback. However, it wants to underline the importance of continuing to monitor and improve this.

With regard to the master, the panel noticed that theses are often assessed by the same pairs of assessors. In the interviews, the programme indicated that it considers this inevitable given the specialist knowledge required to assess the theses. The panel thinks that this practice may negatively affect the consistency across all assessors. Working with a better mix of pairs allows assessors to calibrate with a wider variety of assessors. Therefore, the panel recommends aiming for a more varied mix of assessor pairs where possible and organizing more general calibration for assessors, in order to ensure that grading is consistent across assessors.

For the master specializations SiS and SMI, the thesis trajectory has a slightly different setup than in the other five specializations. However, the theses are compatible in scope and depth. Theses from these specializations were included in the sample reviewed by the panel. The thesis from SMI included in the sample raised some questions among the panel, as there was virtually no computer science content in the thesis. This raised concerns about the question to what extent students in this specialization are assessed on all ILOs. This issue was discussed with the programme in various interviews. The programme indicated that it agrees with the panel's concern and already initiated improvements. The programme will develop guidelines to make sure that a supervisor from ICIS is involved in each SiS/SMI thesis and that each thesis includes sufficient content specific to computer science. The panel is confident that these measures will solve this issue and recommends the programme to implement them.

Assessment of the master research internship
Similar to the thesis, the research internship in the master is assessed based on a report and a presentation. Since the research internship is intended as an opportunity to practice and learn, the requirements with regard to research results are less stringent than for the thesis, and more emphasis is placed on the process and the reflection on the learning process. In line with this, the research internship is graded with a 'pass' or 'fail' only, and is assessed by a single assessor. The panel agrees with this approach and considers the assessment of the research internship to be adequate.

Examination Board
There is a shared EB for the bachelor and master Computing Science and the master Information Sciences. The EB appoints examiners and handles student requests and complaints. Besides this, the EB monitors the quality of assessment in the programmes. It reviews a selection of course files each year, to check the completeness of the files, the alignment between the learning goals and the assessment, and the quality of the assessment. The EB also reviews a sample of bachelor and master theses each year, to check whether the exit level is demonstrated in the theses, whether the grades given are appropriate, and whether the grading process is transparent. In these samples, all master specializations (including SMI and SiS) are covered.

The panel is very positive about the EB. It considers the EB to be independent, competent, and in control. The EB has a strong position in the faculty and is listened to. It is also proactive in safeguarding the quality of assessment and the exit level of the programmes. The panel appreciates the procedures in place to do this, such as the annual reviews of course files and theses.

Considerations
The panel considers the assessment in both programmes to be well designed and aligned with the ILOs. A variety of appropriate assessment methods is used and appropriate measures are taken to improve and ensure the quality of assessment in the programmes, such as the peer-reviews of tests, the use of test matrices, and the use of rubrics or correction models. The panel recommends developing guidelines and policies concerning GenAI on programme level. According to the panel, the thesis assessment procedure for both the bachelor and the master is adequate, as the four-eyes principle is applied and grading is done based on clear assessment forms and rubrics. The panel notes that recent measures were taken to improve the quality of the written feedback on the assessment forms and underlines the importance of continuing to monitor and improve this. With regard to the master, the panel recommends aiming for a more varied mix of assessor pairs where possible and organizing more general calibration for assessors, in order to ensure that grading is consistent across assessors. With respect to the master specializations SiS and SMI, the panel recommends implementing the new guidelines proposed by the programme to ensure that theses from these specializations contain sufficient content related to computer science. The panel considers the EB to be independent, competent, in control, and proactive with regard to safeguarding the assessment quality in the programmes.

Conclusion
The panel concludes that the bachelor's and master's programme Computing Science meet standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Theses
As mentioned earlier, both programmes regard the thesis as the final student project, demonstrating the achieved level of students. The panel reviewed a sample of 15 theses per programme. The panel concludes that the theses from both programmes are of high quality, reflecting a level that is appropriate for an academic bachelor’s/master’s programme.

Alumni
According to the panel, it is evident from the documentation and the interviews that bachelor graduates are well prepared to continue in a master’s programme or to enter the labour market. Most graduates choose to pursue a master’s programme. About two-thirds of the graduates continue with a master’s programme at the Radboud University.

The documentation and the interviews show that graduates from the master generally perform well in the professional field. The majority of graduates move on to work in industry, while over 10% stays in academia to pursue a PhD degree. Graduates usually find a job relatively easily and work in positions related to software engineering, data science, and cybersecurity. The interview with alumni and representatives of the professional field made clear that the industry is very happy to welcome graduates. Alumni indicated that the master generally prepared them well for the labour market. There may be specific gaps in knowledge or skills related to the particularities of the company or position, but, according to alumni, these deficiencies can easily be repaired on the job as the programme has taught them to quickly learn new things.

Considerations
Based on the review of a sample of 15 theses per programme, the panel concludes that the level demonstrated in the theses is appropriate for an academic bachelor’s/master’s programme. The documentation and the interviews indicate that graduates of the bachelor are well equipped to follow a master’s programme or enter the labour market. Graduates of the master are well prepared for and prove to be successful in the professional field.

Conclusion
The panel concludes that the bachelor’s and master’s programme Computing Science meet standard 4.

General conclusion
The panel’s judges that the bachelor’s and master’s programme meets all four standards. The panel’s assessment of the programmes is therefore positive.

Recommendations

Both programmes

1. Consult the CAV in a more structural way at a strategic level. Revive the CAV meetings and regularly consult it about the profiles, ILOs, curricula, and alignment with (developments in) the industry. Look into the composition of the CAV to make sure that it is a good representation of the broad professional field.
2. Look into the feasibility and workload of individual courses and the curricula as a whole, to see if there are any structural issues or bottlenecks that may cause study delay, and implement improvement measures accordingly.
3. Improve the communication between the PC and the Education Board, in order to ensure that all points raised by the PC are properly addressed. This may be achieved by the Director of Education attending the PC meetings and by ongoing efforts to re-establish trust and create a constructive culture and dynamic between the PC and the Education Board.
4. Develop guidelines and policies concerning GenAI on programme level.

Bachelor

5. Make the learning pathway for academic writing skills more explicit and visible for both students and staff. Monitor if these skills are adequately addressed and assessed in the relevant courses. Develop similar learning pathways for other academic and soft skills, including ethics.

Master

6. Revise the overarching ILOs that apply to all specializations. More specific elements related to computer science should be included in these, in order to ensure that all specializations have discipline-specific ILOs. This is especially relevant in light of the two societal specializations, as their specialization-specific ILOs do not refer to computing science.
7. Look into the knowledge gap, specifically concerning cryptology, that some admitted students in the specializations ‘Cyber Security’ and ‘Cyber Security and AI’ struggle with. Explore possible solutions and consider arranging interviews with students before the start of the programme to check their prior knowledge and advise them on possible deficiency repair programmes.
8. Aim for a more varied mix of thesis assessor pairs where possible and organize more general calibration for thesis assessors, in order to ensure that grading is consistent across assessors.
9. Implement the new guidelines proposed by the programme to ensure that theses from the specializations SiS and SMI contain sufficient content related to computer science.

Appendix 1. Intended learning outcomes

Bachelor Computing Science

General end terms
The student has acquired knowledge and skills at the intended area (computing science), as well as:
(a) the student has an academic attitude
(b) the student is prepared for a next (study) career step

(System) Development
The student can describe and select system development methods. The student can solve system development challenges at a basic level (i.e. challenges that require application of one or several standard methods, including adaptation to the required situation). The student can:
(a) invent a suitable application for a given situation
(b) assemble the system requirements
(c) design an application and justify its design
(d) implement an application in a team and / or individually
(e) evaluate an application regarding functional correctness and usability
(f) document the final product

Research
The student can describe and select appropriate (generic and discipline specific) research methods. The student can solve research problems at a basic level. The student can:
(a) determine a relevant problem statement
(b) formulate and justify a matching research question, hypothesis
(c) describe and justify a matching theoretic context and research method
(d) perform the research
(e) report and present the results
(f) invent and justify a(n innovative) scientific solution to a problem

Communication
The student can present and document computing science related material at a basic level in a clear manner to their peers. The student can fulfill several roles in project teams.

Reflection
Given a problem at basic level, the student can identify relevant computing science domains and their contributions, in particular with respect to the skills mentioned below:
(a) reflect on their role as junior academic
(b) participate in discussions concerning the impact in society of computing science developments
(c) identify characteristic functions, roles, activities, and competences of computer scientists in a job context
(d) make a well informed decision concerning a specific subsequent (master) study or otherwise

Core
The student can perform the above-mentioned activities in, and using knowledge from, the following computing science domains:
(a) algorithms and theory
(b) programming

(c) computer systems and security
(d) information and knowledge systems
(e) mathematics
(f) law

Theme: Cyber Security
The student can also:
(a) analyse security problems and their causes
(b) describe and apply security -techniques, -cryptography, -guidelines, and -principles

Theme: Software Science
The student can also:
(a) implement platform specific applications for embedded computers
(b) describe the semantics of programming languages in suitable formalisms
(c) analyze the behavior of programs using computational models and tools

Theme: Data Science
The student can also:
(a) identify techniques for extracting relevant information out of big data
(b) identify fundamental search techniques, explain their differences, select and implement them

Double Bachelor Mathematics & Computing Science
The student can:
(a) perform the activities mentioned in core using the deepened knowledge from mathematics and logic
(b) perform the activities mentioned in core using the deepened knowledge from computing science in combination with their selection of one of the themes (Cyber Security, Software Science, Data Science)

Master Computing Science

General learning outcomes
The study programme has the following learning outcomes for students:
1. Acquire knowledge, understanding and skills in the relevant field of study
2. Develop academic competences
3. Prepare for a future career
4. Deepen qualifications in the area of independent academic research

1. **All Computing Science graduates:**
   (a) Can work and think at an academic level;
   (b) Have thorough academic knowledge and insight in the area of their specialisation (discussed in more detail below per specialisation), are experts in a sub-area within their specialisation, and can contribute to the further academic development within this sub-area, and are able to acquire knowledge, insight and skills in other sub-areas of Computing Science
   (c) Can apply their knowledge and skills to research and system development issues, both independently and in small teams. Depending on the chosen specialisation and expertise, the emphasis here may be on research or system development;
   (d) Understand the societal aspects of ICT;
   (e) Are able to communicate at a professional level and provide a clear oral and written presentation of their own or someone else's completed work.

2. Graduates in the **Software Science** specialisation:
   (a) Possess broad knowledge of state-of-the-art techniques for the development and analysis of software (including software technology, domain-specific languages, computer-aided analysis, and the use of mathematic models and modelling techniques);
   (b) Are able to apply these techniques.

3. Graduates in the **Data Science** specialisation:
   (a) Have a broad overview of the data science discipline (incl. algorithmic, organisational, software, hardware and ethical aspects);
   (b) Are able to use appropriate data science techniques to extract insights from data;
   (c) Are experienced with specifying, designing and creating applications in which data science plays an important role;
   (d) Can contribute to discussions about the role of data science in society.

4. Graduates in the **Cyber Security** specialisation:
   (a) Possess broad knowledge of information and computer security (including organisational, software, hardware, network, cryptographic, legal and privacy aspects);
   (b) Can evaluate the security aspects of existing systems and systems yet to be developed and to this end are able to formulate and prioritise safety requirements;
   (c) Are experienced in specifying, designing or developing applications in which safety plays an important role;
   (d) Can contribute to discussions on the role of cyber security and privacy in society.

5. Graduates in the **Cyber Security and AI** specialisation:
   (a) Have a broad knowledge of information and computer security and artificial intelligence;
   (b) Can apply state-of-the-art artificial intelligence within the context of security;
   (c) Have experience in specifying, designing and developing secure machine learning systems;
   (d) Have a broad overview of the role of artificial intelligence in the design of secure systems;
   (e) Understand the importance of secure machine learning systems.

6. Graduates in the **Mathematical Foundations of Computer Science** specialisation:
   (a) Have a broad knowledge of theoretical computing science and the mathematics that serve as its foundation;
   (b) Can apply mathematical techniques (such as logic and algebra) in modelling and analysing computing science concepts.

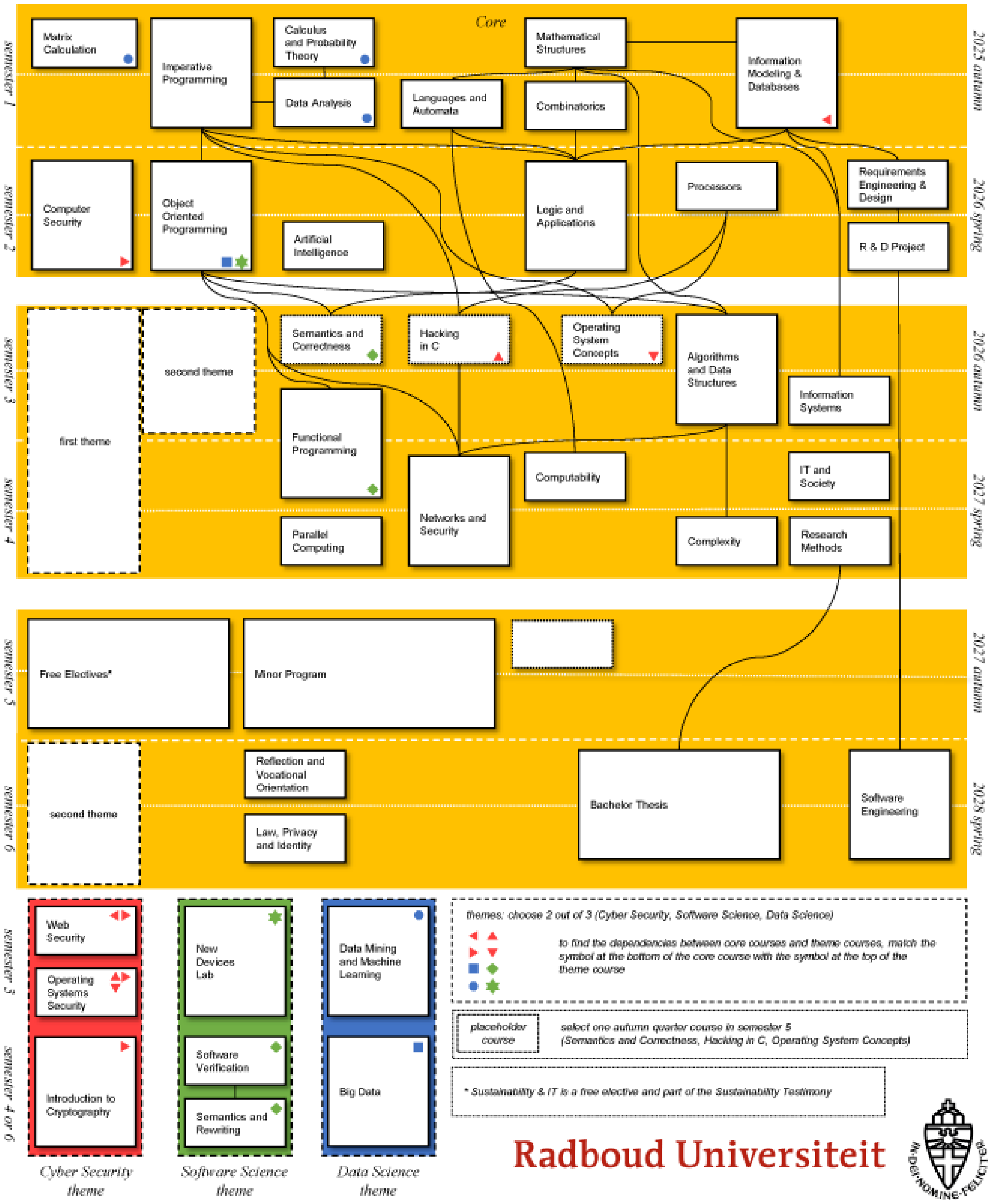
7. Students who opt for the **Science, Management and Innovation** specialisation will also achieve the following learning outcomes:
   a. Graduates are able to bridge the gap between their own scientific discipline and other disciplines, based on a profound understanding of their chosen core theme and its relation to political, business/economic, societal, technological, environmental and legal issues or objectives in today's world.
   b. Graduates are able to take an analytical approach to a system that can draw on methods or models from both inside and outside their core scientific discipline.
   c. Graduates have developed a proficiency in utilising research methods and frameworks from the social sciences.

d. Graduates have developed a proficiency in speaking the language of both the natural and social sciences to effectively communicate in written and spoken form the problems and approaches for solutions that are found at the intersection of scientific research and applications in society.
e. Graduates have developed the ability to balance perspectives and interests in specific contexts within a company, government and non-government organisation or an industry in the general sense in order to formulate appropriate strategies and recommendations that can be utilised towards the realisation of the Sustainable Development Goals (SDGs).
f. Graduates have developed the ability to work in multidisciplinary and multicultural high-performance teams based on a sound division of tasks, knowledge, competencies, and responsibilities, whilst respecting diverging views and opinions.

8. Students who opt for the **Science in Society** specialisation also:
   a. Develop the ability to analyse the role of scientific expertise in societally relevant issues.
   b. Develop the ability to design and conduct independent, methodologically sound research about the interface of science and society, and contribute to academic research.
   c. Develop the ability to understand and implement public and stakeholder engagement in research and innovation.
   d. Develop the ability to analyse, improve and evaluate interdisciplinary collaborations with multiple stakeholders, integrating different perceptions, interests and types of knowledge (experiential, professional and scientific).
   e. Develop the ability to substantiate and communicate the relevance of their scientific discipline in society

Appendix 2. Programme curriculum

Bachelor Computing Science



Master Computing Science

Each master specialization consists of the same basic components:

1. **Mandatory courses** (21-33 EC)
   These provide the foundation of the specialization. There are two common components in the mandatory courses of all specializations:
   - Philosophy and Ethics for Computing and Information Science (3 EC)
   - A specialization-specific research seminar (6 EC)

   The other mandatory courses differ per specialization, as per the overview below.
2. **Specialization electives** (24-30 EC)
   Every specialization has a set of specific elective courses that students can choose from.
3. **Master electives** (12-24 EC)
   Students can choose courses from all Computing Science specializations in this category.
   The total of 1-3 is always 69 EC.
4. **Free electives** (6 EC)
   This can be any course in any area.
5. **Research internship** (15 EC)
   The student does an internship at a company or research department of their own choice.
6. **Master thesis** (30 EC)

The current list of mandatory courses and specialization electives per specialization is as follows.

Software Science
Mandatory courses:
- Advanced Programming (6 EC)
- Testing Techniques (6 EC)

Specialization electives:
- Compiler Construction (6 EC)
- Software Product Lines (6 EC)
- Software Development Entrepreneurship (6 EC)
- Software Security (6 EC)
- Proof Assistants (6 EC)
- Model Checking (6 EC)
- Automated Reasoning (6 EC)
- Type Theory and Rocq (6 EC)
- Semantics and Domain Theory (6 EC)
- Category Theory and Coalgebra (6 EC)
- Program Verification with Types and Logic (6 EC)
- Human-Centered Security and AI (3 EC)
- Data Engineering (3 EC)
- Green Software (6 EC)

Data Science
Mandatory courses:
- Information Retrieval (6 EC)
- Machine Learning in Practice (6 EC)

- Statistical and Causal Inference (6 EC)
- Deep Learning 1 (3 EC)

Specialization electives:

- Statistical Machine Learning (6 EC)
- Natural Computing (6 EC)
- Deep Learning 2: Deeper Learning (3 EC)
- Artificial Intelligence in Medical Imaging (6 EC)
- Complex Adaptive Systems (6 EC)
- Pattern Recognition for Natural Science (6 EC)
- Text and Multimedia Mining (6 EC)
- Law and Technology (6 EC)
- Foundations of Information Systems (6 EC)
- New Media Lab (6 EC)
- (Automatic) Speech Recognition (6 EC)
- Machine Learning in Particle Physics and Astronomy (6 EC)
- Security and Privacy of Machine Learning (6 EC)
- Data Engineering (3 EC)
- Generative AI (3 EC)
- Green Software (6 EC)
- Introduction to Neuromorphic Human-Computer Interaction (3 EC)

Cyber Security

Mandatory courses:

- Software Security (6 EC)
- Security in Organisations (6 EC)
- Advanced Network Security (6 EC)
- Applied Cryptography (6 EC)

Specialization electives:

- Security Protocol Project (3 EC)
- Physical Attacks on Secure Systems (6 EC)
- Law and Technology (6 EC)
- Engineering Cryptographic Software (3 EC)
- Hardware Security (3 EC)
- Machine Learning in Practice (6 EC)
- Statistical Machine Learning (6 EC)
- Deep Learning 1 (3 EC)
- Deep Learning 2: Deeper Learning (3 EC)
- Program Verification with Types and Logic (6 EC)
- Cryptology (6 EC)
- Online Tracking and Privacy (6 EC)
- Security and Privacy of Machine Learning (6 EC)

Cyber Security and AI

Mandatory courses:

- Applied Cryptography (6 EC)
- Security and Privacy of Machine Learning (6 EC)
- Deep Learning 1 (3 EC)
- Deep Learning 2: Deeper Learning (3 EC)

Specialization electives:

- Law and Technology (6 EC)
- Physical Attacks on Secure Systems (6 EC)
- Online Tracking and Privacy (6 EC)
- Human-Centered Security and AI (3 EC)
- Advanced Network Security (6 EC)
- Natural Computing (6 EC)
- Machine Learning in Practice (6 EC)
- Statistical and Causal Inference (6 EC)
- Applied Machine Learning (6 EC)

Mathematical Foundations of Computer Science

Mandatory courses:

- Type Theory and Rocq (6 EC)
- Category Theory and Coalgebra (6 EC)

Specialization electives:

- Automated Reasoning (6 EC)
- Proof Assistants (6 EC)
- Semantics and Domain Theory (6 EC)
- Model Checking (6 EC)
- Program Verification with Types and Logic (6 EC)
- Computer Algebra (8 EC)
- Complexity Theory (8 EC)
- Computability Theory (8 EC)

Appendix 3. Programme of the site visit

Thursday 30 Oct 2025

11.00	11.25	Welcome and panel preparation
11.25	12.25	Interview programme management
12.25	13.30	Lunch break (incl. tour Mercator)
13.30	14.15	Interview BSc students
14.30	15.15	Interview MSc students
15.15	15.45	Break
15.45	16.45	Interview teaching staff
17.00	17.45	Interview professional field and alumni
17.45	18.15	Internal panel session

Fri 31 Oct 2025

08.45	09.15	Panel preparation
09.15	09.45	Board of Examiners
09.45	11.00	Internal panel session
11.00	11.30	Concluding session programme management
11.30	12.30	Internal panel session (incl. lunch)
12.30	13.45	Thematic session
14.00	14.30	Oral report panel and closure

Appendix 4. Materials

Prior to the site visit, the panel studied 15 theses per programme. Information on the theses is available from Academion upon request.

The panel also studied other materials, which included:

- Self-evaluation report, including appendices:
  - Domain-specific reference frame for the bachelor programme
  - Schematic overview bachelor curriculum
  - Bachelor programme constituents and intended learning outcomes
  - Overview master curriculum
  - Master programme constituents and intended learning outcomes
  - Education- and Examination Regulations
  - Overview of teaching personnel
  - Publications by students
  - Assessment forms internship/thesis
  - Lecturer course evaluation form
  - Reflection on the previous accreditation
  - Student chapter
- End terms and test matrices
- Annual Reports Education Board, 2022-2023-2024
- Annual Reports Examination Board, 2021-2022, 2022-2023, 2023-2024
- Annual Reports Programme Committee, 2021-2022, 2022-2023, 2023-2024
- Course files of selected courses (2022-2023-2024):
- EER documents 2022 – 2023 – 2024 – 2025 (English version)
- Prospectus information
- Results Evaluation Graduated students
- Results National Student Enquiry (NSE), 2023-2024-2025
- Commissie Afnemend Veld – verslag update
- Examiner policy of the Faculty of Science
- Overview PPD skils – definitions and levels
- PPD Presentation iCIS 2024 (work in progress)
- Teacher's days 2022-2023-2024
- Thesis and Internship – assessment forms and instructions