Informatica
Utrecht University

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Project code P2409

Contents

Summary

Standard 1. Intended learning outcomes

The bachelor *Informatica* (Computer Science) aims to enable students to develop a deep understanding of the foundational principles of computing, providing students with a solid basis in algorithms, data science, graphics, and programming languages. Students acquire skills for critical and abstract thinking that enable them to adapt to an ever-evolving technological landscape. The programme values connecting computer science to society, allowing students to apply their knowledge and skills to real-life assignments for external clients and to learn to collaborate in a team. The vision of the master *Informatica* (Computer Science) is to develop future leaders in computer science. The programme aims to educate scholars and practitioners with a deep understanding of foundational and emerging technologies in computing who can drive scientific innovation and technological advancements in academia, industry, and society. The programme is research-oriented and focuses on scientific expertise, ethical problem-solving, and cross-domain collaboration.

The panel is positive about both programmes' profiles, which are relevant and clear. By offering considerable space for electives and the option to obtain double diplomas with other programmes, the programmes allow students to create their own study path according to their interests and ambitions, which is a strength of the programmes. 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 levels. The ILOs cover all relevant areas and match with both the academic and professional fields.

The panel sees that the programmes have various valuable connections with industry but thinks that these need to be extended. To improve connections and alignment between education and industry, the panel recommends further engaging the advisory board on a strategic level in a structural way. Furthermore, the panel recommends making a systematic inventory and analysis of current connections, in order to improve coordination on programme level and to identify possible gaps for which additional industry partners need to be engaged.

Standard 2. Teaching-learning environment

According to the panel, the bachelor curriculum is well designed. The panel appreciates the wide choice of electives. The alignment with the ACM (Association of Computer Machinery) model curriculum is another strong point, ensuring that the curriculum is aligned with the academic and professional fields. The Software Project, which serves as the final student project (instead of a bachelor thesis), is a valuable feature of the curriculum, allowing students to develop soft skills and apply their knowledge and technical skills in a professional context. In the programme, there is no separate course on mathematics. Mathematics is integrated into other courses and always taught in the context of where it is applied. The panel values this approach but recommends developing a coherent learning pathway for mathematics that visualizes and makes explicit where the required mathematics is addressed and assessed. The panel also recommends reflecting on the attention for academic skills and ethics and considering increasing it. As with mathematics, the programme may benefit from a clear learning pathway for academic skills and ethics.
The curricula for the three master tracks are coherent and well designed, covering the necessary foundational knowledge while also allowing students the flexibility to tailor the programme to their own interests and ambitions. The programme has a strong academic orientation as it contains a substantial research component.

The master is taught in English, which, according to the panel, follows logically from the inherent international nature of the field of computer science. The learning environment of both programmes is

adequate and characterized by a combination of theory-heavy teaching methods and hands-on practice. Interactions with industry are considered fundamental, as computer science is a practical science. The panel concludes that the programmes have implemented various valuable interactions with industry in courses, such as guest lectures, real-life cases, assignments for external clients, internships, and career events. However, the panel thinks that further efforts are needed to achieve the desired level of industry integration within the curricula and recommends increasing the interactions with the professional field in courses, specifically in the master tracks 'Game and Media Technology' and 'Data Science'.

According to the panel, the admission criteria are appropriate. The panel also considers the programmes to be feasible within the allocated time. The panel notes that there remains room for improvement in ensuring the feasibility of the master thesis project, as some delay is caused by difficulties in finding a thesis supervisor. The panel learnt that adequate support in finding a supervisor is in place but not all students are sufficiently aware of this. It recommends improving communication to students about this.

The panel is very positive about the overall student guidance in the programmes, provided by study advisors and, in the bachelor, tutors. The supervision during the bachelor Software Project and master thesis is also well structured. To further strengthen guidance during the master thesis project, the panel recommends considering the implementation of intervision groups for thesis students. There is a strong sense of community among the bachelor students and part of the master students. International master students and master students who come from other bachelor programmes appear to have some difficulties in connecting with other students and integrating into the community. The panel recommends looking into this issue and exploring ways to strengthen the sense of community among all students in the master.
Facilities for students with a disability are appropriate and sufficient. Students have easy access to all relevant information through the online learning environment Brightspace. Various lab facilities are valuable add-ons to the programme. With regard to computer facilities, the panel recommends developing a streamlined infrastructure that ensures the required availability of computing services for students in courses as well as the thesis project.

The teaching staff of the programmes represents all relevant areas of expertise. Lecturers have strong research profiles and are didactically qualified. The panel appreciates the team's enthusiasm, commitment, and supportive attitude towards students. To further enhance the quality of teaching in the bachelor, the panel recommends increasing the number of full professors who teach in the bachelor. Another point of improvement concerns the communication among lecturers and the alignment across courses. The panel recommends to further strengthen the alignment meetings in the bachelor and to implement similar sessions in the master.

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 applied and appropriate measures are taken to improve and ensure the quality of assessment in the programmes, such as the peer-reviews of assessments, the use of assessment matrices, and the use of rubrics. The panel appreciates how the programmes deal with the impact of AI on assessment. The assessment procedure for the bachelor Software Project is adequate and well set up. The panel appreciates the intervision and calibration integrated in the grading process, as multiple lecturers are involved in the grading process. Furthermore, the grading process results in justified individual grades thanks to a careful assessment process throughout the project. The assessment procedure for the master thesis is also adequate, as theses are assessed by two assessors, based on an assessment form including written feedback. The panel considers the Board of Examiners (BoE) of both the bachelor and the master to be independent, competent, in control, and proactive with regard to safeguarding the assessment

quality in the programmes. The panel does recommend the BoE of the bachelor to implement regular external reviews of samples of the bachelor's Software Project, possibly similar to the annual intervision sessions for the master theses, in order to guarantee the exit level of the bachelor.

Standard 4. Achieved learning outcomes

Based on the review of the products of a sample of five teams (44 students in total) from the bachelor Software Project and a sample of 15 theses from the master, the panel concludes that the level demonstrated in the final projects 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:

Bachelor programme Computer 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

Master programme Computer 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: 17 March 2026

Introduction

Procedure

Assessment

On 6 and 7 October 2025, the bachelor's programme and master's prorammes *Informatica* (for which the international name Computer Science will be used in the remainder of the report) of Utrecht 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 Computer 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 Utrecht 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 at 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 in the form of thematic sessions. A separate development report was made based on this dialogue.

The programmes provided the coordinator with a list of graduates over the period 2023-2025. In consultation with the coordinator, the panel chair selected five group projects from the bachelor's programme (44 students in total, in mixed groups from the tracks Computer Science and Game Technology) and 15 master's theses: 8 from the track Computing Science and 7 from the track Game and Media Technology. They took the diversity of final grades and examiners into account. This selection reflected the number of graduates in each particular track proportionally. The master's track Data Science 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 file 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 framework, 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. One staff member requested a consultation. 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 the Faculty of Science, Utrecht University.

Panel

The panel assessing the B and M Computer Science at Utrecht University 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. M. (Marieke) Huisman, professor Software Reliability at the Faculty Electrical Engineering, Mathematics and Computing Science at the Twente University
- Prof. dr. M. (Marco) Aiello, professor of Service Computing at the University of Stuttgart
- Prof. dr. ing. N. (Norbert) Fuhr, professor Computer Science at the Universität Duisburg-Essen
- Prof. dr. ir. A.M.C.A. (Arie) Koster, professor Discrete Optimization at the RWTH Aachen University
- F.P. (Floris) Westerman MSc, alumnus of the master programmes Computer Security at the Vrije Universiteit Amsterdam, Computing Science at University of Groningen, and Logic at the University of Amsterdam [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:	Utrecht University
Address:	Heidelberglaan 8, 3584 CS Utrecht
Website:	www.uu.nl
BRIN-number:	21PD
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive

Programme name:	Informatica
ISAT number:	56978
Orientation of the programme:	Academic
Level of the programme:	Bachelor (NLQF 6)
Number of credits:	180 EC
Language of instruction:	Dutch
Professional requirements:	no
Location:	Utrecht
Mode(s) of study:	Fulltime
Tracks:	Informatica Gametechnologie
Educational minor	yes
Assessment group:	Computer Science
Awarded degree:	BSc
Submission date NVAO:	1 May 2026

Programme name:	Informatica
ISAT number:	66978
Orientation of the programme:	Academic
Level of the programme:	Master (NLQF 7)
Number of credits:	120 EC
Language of instruction:	English
Professional requirements:	no
Tracks:	Computing Science Game and Media Technology Data Science (per 2023-2024)
Location:	Utrecht
Mode(s) of study:	Fulltime
Assessment group:	Computer Science
Awarded degree:	MSc
Submission date NVAO:	1 May 2026

Description of the assessment

Organization

The bachelor and master programmes Computer Science are offered by the Faculty of Science of the Utrecht University. Utrecht University consists of seven faculties, offering 59 bachelor's programmes and 150 master's programmes. Over 39,000 students are enrolled at the university. The Faculty of Science offers eight bachelor's programmes and twelve master's programmes in the domains of information and computing science, mathematics, physics, chemistry, biology, and pharmaceutical sciences. The bachelor Computer Science is part of the faculty's Undergraduate School of Sciences (UGS) and is a Dutch-taught BSc programme. Currently, over 650 students are enrolled in the programme. The master Computer Science is part of the faculty's Graduate School of Natural Sciences (GSNS), and is an English-taught MSc programme. At the moment, around 350 students are enrolled in the programme.

Recommendations previous panel

The previous accreditation of the bachelor and master Computer 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. For the bachelor, improvements include aligning and improving the courses on artificial intelligence (AI) and improving the rubric for assessment in the Software Project. For the master, improvements include measures to increase engagement in the colloquia, the introduction of a mandatory course on scientific methods, enhancing the (student awareness of) options for electives from other programmes and/or in collaboration with other institutions, and measures to decrease study delay during the thesis project. 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

Bachelor

The bachelor Computer Science aims to enable students to develop a deep understanding of the foundational principles of computing, providing students with a solid basis in algorithms, data science, graphics, and programming languages. Students acquire skills for critical and abstract thinking that enable them to adapt to an ever-evolving technological landscape. The programme values connecting computer science to society, allowing students to apply their knowledge and skills to real-life assignments for external clients and to learn to collaborate in a team. The programme offers two tracks: 'Informatica' and 'Gametechnologie'. (In the remainder of the report, the English track names will be used: 'Computer Science' and 'Game Technology'.) The track Computer Science covers topics from the broad field of computer science, while the track Game Technology allows students to develop a deeper understanding of the technologies of computer games, including application areas such as serious gaming and interdisciplinary

research areas such as music and media technology. The track Game Technology, which draws on the expertise of the staff with regard to graphics and interaction technology, is unique, as it is not offered by any other university in the Netherlands.

Master

The vision of the master Computer Science is to develop future leaders in computer science. The programme aims to educate scholars and practitioners with a deep understanding of foundational and emerging technologies in computing who can drive scientific innovation and technological advancements in academia, industry, and society. The programme is research-oriented and focuses on scientific expertise, ethical problem-solving, and cross-domain collaboration. The programme offers three tracks: 'Computing Science' (COSC), 'Game and Media Technology' (GMT), and 'Data Science' (DASC). COSC focuses on operations research, algorithms and programming technology. GMT addresses the technological aspects of games and multimedia in the context of computer science, including simulations, interactive 3D systems and content, audio, images, and video. Similar to the 'Game Technology' track in the bachelor, this track is unique in the Netherlands: no other university offers a similar programme or track. DASC is a new track that was introduced in the academic year 2023-2024. It concerns all aspects of data processing, from collecting and cleaning, to analysing and visualizing. Students are trained to apply analytical tools, algorithms, and machine learning principles to improve existing technologies and create new functionalities of data processing.

Both programmes

The panel considers both programmes' visions to be relevant, clear, and appropriate. The panel notes that, although the three master tracks are quite separate, the three tracks all address the same foundations of computer science, yet from different perspectives, and work towards the same overall graduate profile of computer scientists.

In line with the university's vision on education, both the bachelor and the master provide students with substantial space for electives, allowing them to pursue their own interests. Furthermore, students have the possibility to get a double diploma. Bachelor students can combine Computer Science with Mathematics or with Information Science. A double diploma is also an option for master students, who can combine Computer Science with master programmes such as Artificial Intelligence. From the interviews during the site visit, the panel learnt that students much appreciate the space to tailor the programmes to their own interests and the possibility to obtain a double diploma. The panel values how students are enabled to create their own study path and considers this a strength of the programmes.

Intended learning outcomes

For the bachelor, 12 intended learning outcomes (ILOs) were formulated, categorized along the five Dublin descriptors (see Appendix 1 for an overview). No additional ILOs were formulated for the two tracks. For the master, a separate set of ILOs was formulated for each track (see Appendix 1 for an overview). For both COSC and GMT, 16 ILOs were formulated, whereas for DASC, 24 ILOs are described. The ILOs of all three tracks are categorized along the five Dublin descriptors. Although the ILOs were formulated separately for each track, they share a common foundation: most ILOs are identical or very similar across the tracks, with differences primarily consisting of specifications or additional elements.

According to the panel, the ILOs of both the bachelor and the master are well formulated and 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 the programmes' visions and the expectations of the academic and professional field.

Professional field
Both programmes value a strong connection with industry. From the documentation and the interviews, the panel learnt that various staff members have connections with partners in the professional field based on their research and/or teaching activities. In several AI Labs, staff members collaborate with experts from external organizations and institutions on specific research themes, which may be linked to course content and/or master thesis projects. Also, several staff members have (temporary) positions in industry. The panel appreciates the various connections with the professional field visible in the programmes and sees that there are many initiatives to create links between education and industry. However, the panel concludes that contacts with the professional field in both programmes are mostly ad hoc and depend largely on individual networks of staff members. Moreover, for the master tracks GMT and DASC particularly, connections with the professional field are limited. The panel thinks that the link with the industry needs to be strengthened and developed in a more systematic and structured way. In the past year, the programmes installed a professional advisory board for Computer Science. The panel recommends continuing to invest in this advisory board and further engaging it. The advisory board should be regularly consulted to reflect on the programmes' visions, ILOs, and curricula, so as to continually align the programmes with developments in the professional field. Furthermore, in order to provide all students with sufficient training in relevant professional contexts, connections with industry need to be better structured. The panel recommends making an inventory of the current industry connections and coordinating this at the central programme level. An overall analysis of current connections may point out specific gaps or weaknesses, for which the programmes can proactively seek to engage new industry partners.

Considerations
The panel is positive about both programmes' profiles, which are relevant and clear. By offering considerable space for electives and the option to obtain double diplomas with other programmes, the programmes allow students to create their own study path according to their interests and ambitions, which is a strength of the programmes. The panel considers the ILOs of both programmes to be well formulated and well aligned with the bachelor's and master's levels. The ILOs cover all relevant areas and match with both the academic and professional fields.

The panel sees that the programmes have various valuable connections with industry but thinks that these need to be extended. To improve connections and alignment between education and industry, the panel recommends further engaging the advisory board on a strategic level in a structural way. Furthermore, the panel recommends making a systematic inventory and analysis of current connections, in order to improve coordination on programme level and to identify possible gaps for which additional industry partners need to be engaged.

Conclusion
The panel concludes that the bachelor's and master's programme Computer 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

Bachelor

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 is structured according to the university-wide education model and guidelines. These guidelines prescribe a major of up to 135 EC and a free elective space of 45 EC. The major in this bachelor consists of ten mandatory courses (75 EC in total), the mandatory 15 EC course Software Project, and a restricted elective space of 45 EC. For the restricted elective space, students can choose six courses from a list of over 20 courses. Seven courses in this list are marked as 'game'-courses. In the track Game Technology, students have to choose at least five 'game'-courses. The first year of the bachelor consists mostly of mandatory courses, while the second year is a mix of mandatory courses and (restricted) electives. In the third year, only two mandatory courses are scheduled, including the Software Project, providing students with considerable free elective space.

The free elective space (45 EC) allows students to follow courses at Utrecht University or at another university in the Netherlands or abroad. As part of the free elective space, students can take a minor offered by other bachelor's programmes at the university. This includes an educational minor (bèta) offered by the university's Graduate School of Teaching. After completing this minor, students receive a second degree teaching qualification, allowing them to teach the school subject 'informatica' in secondary schools in the Netherlands.

The programme offers an honour's programme of 45 EC. Besides completing several courses within the regular curriculum at honour's level (30 EC), these students take two extracurricular honour's courses (15 EC) from a faculty-wide honour's programme. Students are selected for the honour's programme after the first half year of the programme by a selection committee.

The panel considers the bachelor curriculum to be well designed. It is especially positive about the wide choice of (restricted) electives. It is clear from the interview with students that they much appreciate the large elective space, allowing them to create their own study path. The panel is also pleased to see how the curriculum is aligned with the model curriculum of the Association of Computer Machinery (ACM), which is evidenced by the mapping of the bachelor curriculum to the 17 knowledge areas defined in the ACM model curriculum. The alignment with the ACM model curriculum ensures that all relevant areas of computer science are covered and that the curriculum is aligned with the academic and professional fields. Another strong feature of the curriculum is the Software Project, which is scheduled in the third year and serves as the final project of the programme (instead of a bachelor thesis). In the Software Project, students work in teams of 7-10 students on a real-life assignment for an external client, supervised by a lecturer from the programme. The Software Project allows students to develop important soft skills (such as communication with clients, planning, and collaboration) and apply their knowledge and technical skills in a professional context. As such, the Software Project contributes to students' professional career preparation. The interviews show that students greatly value the Software Project. For some students, the Software Project was even a reason for choosing this particular bachelor's programme.

In the curriculum, mathematical content is integrated into other courses, meaning that there are no separate courses on mathematics. In line with the programme's vision, mathematics is always taught in the context of where it is applied. Throughout the curriculum, mathematical topics are incorporated in various courses. The panel is positive about this didactic approach and sees the value of teaching mathematics in context. However, the panel found it difficult to see exactly when and where which aspects of mathematics are addressed in the curriculum. The panel considers it important to have such an overview to be able to ensure that all students learn the required mathematical knowledge and skills, regardless of the electives they choose and the division of tasks in group projects. Therefore, the panel recommends developing a coherent learning pathway for mathematics that visualizes and makes explicit where the required mathematics is addressed and assessed. This will also benefit the alignment of the mathematics offer between courses.

In response to a recommendation from the previous accreditation's panel, the programme made an effort to strengthen the attention for academic skills (such as academic writing, literature research, and statistical analysis). The panel sees that improvements were made, but thinks that academic skills still need further attention. Academic skills are addressed in the course 'Onderzoeksmethoden', and revisited to some extent in other courses, but the panel felt that this could be further improved. Some students indicated they would have wanted more training in skills such as academic writing and exploring and finding literature. The panel sees that the programme is aware of this challenge but it feels that more could be done to strengthen the training in academic skills. It recommends the programme to reflect on academic skills in the current curriculum and consider increasing attention for them. Similar to mathematics, the programme could develop a learning pathway for academic skills to clarify and visualize where these skills are addressed and assessed. Related to this, the panel recommends increasing attention to ethics in the curriculum.

Master

The master consists of 120 EC and is offered as a two-year fulltime programme (see Appendix 2 for an overview of the curricula for the three tracks). The three tracks have separate curricula, but with a comparable structure. Two small courses (0.5 EC each) are shared across the tracks: 'Introducing Natural Sciences' and 'Dilemmas of the scientist'. Besides this, all tracks include a research part (44 EC in total), consisting of the thesis project (40 EC) and a colloquium (4 EC). In the thesis project, students carry out a research project under the supervision of a scientific staff member on a topic relevant to the chosen track. In the Colloquium, students explore their research questions and conduct a literature review. They then write a research proposal which needs to be approved before students can continue with the research activities and thesis. For the remaining 75 EC, each track includes a number of mandatory courses, primary electives, and secondary electives. Primary electives are chosen from a predefined list for each track. Secondary electives may include courses from other tracks and other related master's programmes as well as courses from other universities. For courses not included in the list provided in the Exam and Education Regulations (EER), approval of the programme coordinator and Board of Examiners (BoE) is needed.

The curriculum for COSC includes three mandatory courses (22.5 EC in total), three primary electives (22.5 EC in total) and 30 EC for secondary electives. For the primary electives, the track offers three study paths: programming technology, algorithm design and analysis, and operations research. For each study path, a list of primary electives is provided that students can choose from. Students are also free to compose an alternative study path, with the approval of the programme leader. The curriculum for GMT includes two mandatory courses (15 EC in total), six primary electives (45 EC in total), and 15 EC for secondary electives. The DASC curriculum includes four mandatory courses (30 EC in total), five primary electives (37.5 EC in total), and 7.5 EC space for secondary electives.

GSNS offers several school-wide profiles. A profile is a coherent set of courses of 30 EC in total that is followed together with students from other programmes. When students choose to follow a profile, this profile replaces 30 EC from the regular curriculum. COSC and GMT offer the following profiles: Complex Systems, Educational, Science-based Entrepreneurship, Communication, and the Da Vinci programme (in which students work in interdisciplinary teams on sustainability-related challenges). DASC students can choose the profile Complex Systems. Students who follow a profile, still need to achieve all the ILOs of their chosen track. To ensure this, the EER stipulates which courses may be replaced by the profile.

According to the panel, the curricula for the three master tracks are coherent and well designed, addressing all relevant topics and skills. There is an effective balance between covering the necessary foundational knowledge and allowing students the flexibility to tailor the programme to their own interests and ambitions. The panel is pleased with the strong academic orientation evident in the substantial research component. Although the curricula of the three tracks are separate as there is only a limited number of shared courses across all tracks, the courses cover the same skills and the content of all three tracks fits well within the umbrella of the Computer Science programme.

Learning environment
The didactic approach in the programmes is based on the university's educational model. Aspects of this didactical vision include a focus on research-based education and attention to university community building and on-campus education. Educational activities should activate students in their learning process in a context-rich environment, fostering collaborative learning, reflection, and dialogue. The programmes combine theory-heavy teaching methods with hands-on practice, such as practicals, lab work, and (group) assignments. The panel considers the educational vision to be adequate and appreciates the teaching methods applied in the programme.

Both the bachelor and the master consider a strong connection to industry to be fundamental, as computer science is a practical science. Practice in a professional context is important to complement the foundational, theoretical curriculum components. Engagement with a professional context also allows students to develop important skills such as problem solving and collaboration and provides them with opportunities for career preparation. From the documentation and the interviews during the site visit, the panel learnt that various partners from the professional field are involved in the programmes as guest lecturers, external clients in projects, or providers of real-life cases and master thesis topics. Some theses are conducted on-site at a company in the professional field. Also, the master track DASC introduced the 'Data Science Research Internship' as a secondary elective (7.5 EC) as of the academic year 2025/2026. Furthermore, career events with alumni presentations are regularly organized. The panel is happy with these activities and sees that the programmes are working on further increasing the interactions with industry in courses. However, master students indicated that the connections with industry are limited at the moment, especially in the GMT and DASC tracks. The panel thinks that further efforts are needed to achieve the desired level of industry integration within the curricula. The panel recommends increasing the interactions with the professional field in courses, specifically in the GMT and DASC master tracks. As mentioned above (under standard 1), greater overall coordination, collaboration, and exchange across courses and programmes are needed to effectively embed structural connections with industry in the curricula.

Language of instruction
The master is taught in English. 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.

Intake and feasibility

The admission criteria are laid down in the EER. The Board of Admission assesses applications and decides on admission. To be admitted to the bachelor, applicants need to have a vwo-diploma (including the subject mathematics B) or a propaedeutic certificate from a hbo-programme (university of applied science) if they can demonstrate sufficient proficiency in the subjects mathematics B, Dutch, and English. Applicants who are 21+ years old, can take an entrance examination (colloquium doctum) to be admitted. For the master, a relevant bachelor's degree (from a research university or a university of applied science) is required. The EER lists various bachelor's programmes that meet the entry requirements for each track. For students who do not meet these requirements, completing a premaster (30 EC maximum) may grant access to the master. The panel agrees with the admission criteria for both programmes and considers them appropriate.

In the past few years, around a quarter of the bachelor students finished the programme within three years, and nearly half of the students finished within four years. For COSC, around a fifth of the students finished within two years, and over half the students within three years. For GMT, the percentage of students who graduated within two years fluctuated between 9% and 32% in the past few years. Around half of the GMT students graduated within three years. As the DASC track was recently introduced, no study success figures are available yet. The panel notes that there is considerable study delay in both the bachelor and the master. However, it considers the programmes to be feasible within the time allocated. No major obstacles to study progress in the curricula or teaching-learning environment were identified from the documentation and the interviews with students and staff. Reasons for delay are often situated outside the programme, such as combining the study with a job and personal circumstances. In the master, the thesis project appears to be one of the causes of delay for students. The programme recently improved the procedure regarding the deadline for the thesis in an effort to decrease study delay during the thesis project. The panel learnt that some students experience delay because they cannot find a thesis supervisor in time. The programme management explained that there is a process in place to support students in finding a thesis supervisor. Both the coordinator of the track (track leader) and the thesis coordinator play a role in this. The panel notes that not all students appear to be aware of these support options and recommends to further improve communication to students about this.

Guidance

In the courses, students are primarily supervised and guided by the lecturers. In the bachelor, practical assistance in seminars is often provided by student-assistants. During the Software Project in the bachelor, the student teams are guided by a supervisor from the programme. Similarly, a thesis supervisor is responsible for guidance during the thesis project in the master.

For overall guidance in both the bachelor and the master, study advisors are available for students with questions or concerns. They can also pro-actively contact students when they are concerned about study progress and refer students to more specialized support, such as the student psychologist, student counsellor, or study choice advisor. Additionally, in the bachelor, a tutor system has been implemented. Students are appointed a tutor who is their first point of contact for any questions and concerns about their study. During the first year this tutor-role is fulfilled by senior students, also called 'stutors'. Stutors are supervised by a stutor coordinator. During the second and third year, the tutors are staff members. Tutors can refer students to the study advisor or other counsellors when necessary.

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. They particularly value the open and personal atmosphere among the staff. With regard to master thesis supervision, students are generally content as well. However, some students struggle with the thesis project as it requires considerable planning

and discipline while working mostly on your own for an extended period of time. Some students indicated that they would benefit from more contact with other students, and mentioned the idea of organizing intervision groups during the thesis project for extra support. The programme management explained that some thesis supervisors facilitate these types of groups, but it is not structurally implemented. The panel recommends that the programme consider organizing this in a structural way, as it may be beneficial for students.

According to the panel, there is a strong sense of community among the bachelor student population. The study association Sticky clearly contributes to this by (helping) organizing various activities, such as lunch-lectures featuring industry and research professionals, network lunches, drinks, game nights, and hackathons. In the master, this sense of community is not as evident. From the interviews, the panel learnt that master students who first did the bachelor at Utrecht University typically still experience a strong sense of community as they already know many of the other master students. Students who come from other bachelor's programmes and international students, however, find it more difficult to connect with other students and integrate into the community. Because of this, social cohesion in the master is weaker. This is partly related to the structure of the master curriculum with three tracks and many electives, which results in smaller groups of students without much interaction across groups. Furthermore, students indicated that the study association Sticky tends to attract more Dutch than international students, and also attracts fewer students from the GMT and DASC track compared to the COSC track. The panel recommends looking into this issue and exploring ways to strengthen the sense of community among all students in the master.

Facilities

The programmes offer various specific lab facilities, particularly for the GMT track of the master, such as the Motion Capture Lab, the Human-Centred Computing Lab, and Lili's Proto Lab. During the site visit, the panel took a tour around some of these facilities. It considers these facilities to be valuable add-ons of the programmes.

Besides lab facilities, high-performance computer facilities are available. Students need these computer services for assignments in courses and (sometimes) for their master thesis projects. However, from the interviews, the panel learnt that some students have difficulties gaining access to the required computing facilities, especially for thesis projects involving data science and computational applications. The programme management explained that the existing computer facilities are primarily dedicated to research. When specific computing facilities are needed in a course, the lecturer needs to secure these facilities for the course or arrange something else. In the case of a master thesis project, the supervisor needs to provide the necessary facilities. The programme management acknowledged that this is not always easy to accomplish and can take more time than it should. The interviews also showed that students and staff are not always fully aware of and informed about the available computing facilities. The panel concludes that the computer services for students need improvement. It seems that, while the required facilities in courses are mostly arranged, support for thesis students falls short. Although adequate computing facilities are available, there is no streamlined process for getting access to these, as it is mostly ad hoc and depends heavily on the involved lecturer or thesis supervisor. The panel recommends developing a streamlined infrastructure that ensures the required availability of computing services for students in courses as well as the thesis project. Necessary resources should be structurally available for students and education.

For the online learning environment, the programmes are in the process of switching from Blackboard to Brightspace. In the online learning environment, 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 information provision is adequate.

For students with a disability, special arrangements can be made. The study advisors are the first point of contact for these matters. They provide information about studying with a disability and assist students in the application 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 team of over 80 lecturers and the master by a team of over 70 lecturers. Nearly all permanent staff have a University Teaching Qualification (UTQ). The panel is positive about the teaching teams. They reflect an international profile and represent all relevant areas of expertise. The lecturers have strong (international) research profiles and are didactically qualified. Furthermore, the panel appreciates the enthusiasm and commitment of the teaching staff. Students are also positive about the lecturers. They especially value that lecturers are easily approachable and very supportive towards students. The panel is satisfied with the English proficiency of the teaching staff of the master. The university has an adequate policy to ensure that all lecturers who teach in English master the English language sufficiently.

According to the panel, there is still room for improvement with regard to the number of full professors who teach in the bachelor. At the moment, the bachelor team includes only five full professors. The programme management indicated they agree on the need to increase the number of full professors in the bachelor, as full professors have an excellent overview of their research area. In line with this, the panel recommends increasing the number of full professors who teach in the bachelor.

Another point of improvement concerns the alignment and communication among lecturers. In the bachelor, alignment meetings were recently introduced. These meetings take place four times a year, after each teaching block. In these meetings, lecturers exchange information about their courses which helps improve alignment between courses. In the master, alignment meetings are not common at the moment. The communication between the track leaders did improve in the past year. The panel recommends continuing the alignment meetings in the bachelor and implementing similar sessions in the master, in order to improve communication between lecturers and alignment across courses. The alignment meetings may also contribute to the further development of a culture of innovation, in which innovation of education is stimulated and rewarded. For instance, educational innovation may be a recurring topic in the alignment meetings. Finally, the communication towards students can be further improved, especially with regard to informing them about what was done with the feedback they gave. As was pointed out by students in the student chapter and the interviews, student feedback on courses could be followed up on more systematically and/or the improvement measures could be better communicated to the students.

For some seminars and practicals in the bachelor, student assistants are employed to help and guide students. Student assistants must have finished the course with good results and must have obtained at least 45 EC from the bachelor programme. They are supervised by the course coordinator. Although the students as well as the management indicated that the quality of student assistants varies, the interview with bachelor students did not point out any major issues in this area to the panel. Students mentioned that, in general, they appreciate the support from the student assistants.

Considerations
According to the panel, the bachelor curriculum is well designed. The panel appreciates the wide choice of electives. The alignment with the ACM model curriculum is another strong point, ensuring that the

curriculum is aligned with the academic and professional fields. The Software Project, which serves as the final student project (instead of a bachelor thesis), is a valuable feature of the curriculum, allowing students to develop soft skills and apply their knowledge and technical skills in a professional context. In the programme, there is no separate course on mathematics. Mathematics is integrated into other courses and always taught in the context of where it is applied. The panel values this approach but recommends developing a coherent learning pathway for mathematics that visualizes and makes explicit where the required mathematics is addressed and assessed. The panel also recommends reflecting on the attention for academic skills and ethics and considering increasing it. As with mathematics, the programme may benefit from a clear learning pathway for academic skills and ethics.
The curricula for the three master tracks are coherent and well designed, covering the necessary foundational knowledge while also allowing students the flexibility to tailor the programme to their own interests and ambitions. The programme has a strong academic orientation as it contains a substantial research component.

The master is taught in English, which, according to the panel, follows logically from the inherent international nature of the field of computer science. The learning environment of both programmes is adequate and characterized by a combination of theory-heavy teaching methods and hands-on practice. Interactions with industry are considered fundamental, as computer science is a practical science. The panel concludes that the programmes have implemented various valuable interactions with industry in courses, such as guest lectures, real-life cases, assignments for external clients, internships, and career events. However, the panel thinks that further efforts are needed to achieve the desired level of industry integration within the curricula and recommends increasing the interactions with the professional field in courses, specifically in the GMT and DASC master tracks.

According to the panel, the admission criteria are appropriate. The panel also considers the programmes to be feasible within the allocated time. The panel notes that there remains room for improvement in ensuring the feasibility of the master thesis project, as some delay is caused by difficulties in finding a thesis supervisor. The panel learnt that adequate support in finding a supervisor is in place but not all students are sufficiently aware of this. It recommends improving communication to students about this.

The panel is very positive about the overall student guidance in the programmes, provided by study advisors and, in the bachelor, tutors. The supervision during the bachelor Software Project and master thesis is also well structured. To further strengthen guidance during the master thesis project, the panel recommends considering the implementation of intervision groups for thesis students. There is a strong sense of community among the bachelor students and part of the master students. International master students and master students who come from other bachelor programmes appear to have some difficulties in connecting with other students and integrating into the community. The panel recommends looking into this issue and exploring ways to strengthen the sense of community among all students in the master.
Facilities for students with a disability are appropriate and sufficient. Students have easy access to all relevant information through the online learning environment Brightspace. Various lab facilities are valuable add-ons to the programme. With regard to computer facilities, the panel recommends developing a streamlined infrastructure that ensures the required availability of computing services for students in courses as well as the thesis project.

The teaching staff of the programmes represents all relevant areas of expertise. Lecturers have strong research profiles and are didactically qualified. The panel appreciates the team's enthusiasm, commitment, and supportive attitude towards students. To further enhance the quality of teaching in the bachelor, the panel recommends increasing the number of full professors who teach in the bachelor. Another point of

improvement concerns the communication among lecturers and the alignment across courses. The panel recommends to further strengthen the alignment meetings in the bachelor and to implement similar sessions in the master.

Conclusion

The panel concludes that the bachelor's and master's programme Computer 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 assessment policy of UGS (bachelor) and GSNS (master). The assessment policies describe the vision on assessment, the assessment process, and the evaluation of assessment. The assessment policies are further specified in the programmes' assessment plans, which also include matrices that demonstrate in which courses the ILOs are assessed. 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, practical assignments, presentations, reports, and (group) projects.

In line with the assessment policy for the bachelor, each course in the bachelor includes multiple assessment moments, which is much appreciated by the students as it allows them to track their progress. The panel is also happy to see that each test needs to be peer-reviewed before being administered. The assessment policies further prescribe that for each assessment, an assessment matrix should be developed, demonstrating the relation between the learning goals and the questions. Grading should be done based on rubrics or a correction model. The panel concludes that appropriate measures are taken to improve and ensure the quality of assessment in the programmes.

The panel is pleased to see that the programmes have paid serious attention to the impact of AI on assessment. One of the results of these considerations is the recent implementation of new guidelines with regard to assessment, prescribing that at least 50% of assessment must take place in a controlled environment. The university recently published a new policy plan for AI, including an AI index for students. This index describes five categories for the extent to which the use of AI is permitted in assessments, ranging from full prohibition to full permission. For each category, the index describes what is allowed and how students should report on their use of AI. The panel concludes that the programmes are well aware of the challenges related to AI in the context of assessment, and handle these well. The panel encourages the programmes to make sure to communicate their guidelines clearly to staff and students, and to further explore how AI affects not only assessment but also the ILOs, teaching methods, and course content.

Assessment of Software Project (bachelor)

The Software Project is the final student project of the bachelor, in which students demonstrate that they have achieved the ILOs. The Software Project is a group assignment for an external client. Although students work in a team, they receive an individual grade. The grade is based on a combination of the assessment of team products and the input and contribution of the individual student. For the grading, teacher assessment as well as self- and peer-assessment is used. During the Software Project, there are multiple assessment

moments and methods, including the end product, code review, reports, presentations, sprint logbooks, peer-assessment, and contribution. All different assessment moments are combined in the final assessment. The final assessment is always done by multiple lecturers. For each student team, there is one supervisor, who is in the lead for the assessment. The supervisor is supported by one of the course coordinators, another supervisor, and a teaching assistant. The assessment form contains four categories with rubrics: one category (software product) resulting in a grade on team level, and three categories ('reporting and external communication', 'process, collaboration, and communication', and 'technical contribution') that are individually graded.

The panel is positive about the assessment of the Software Project. The panel sees that the programme has significantly improved the assessment process in the past few years. A strong point is the amount of effort that is put into monitoring the process during the project, instead of only assessing the final product. The panel also appreciates the intervision and calibration that are integrated in the grading process, as multiple lecturers are involved in the grading process for each student. Furthermore, the programme succeeds at awarding justified individual grades thanks to a careful assessment process throughout the project. In the interviews, students and alumni indicated that they are happy about the grading process in the Software Project and feel that the grades are fair and justified. As part of the preparation for the site visit, the panel reviewed the products of a sample of five teams (44 students in total), including the filled-in assessment forms. The panel agrees with the grades awarded and considers the grades to be well substantiated with good feedback.

Thesis assessment (master)
In the master, the thesis is considered the final student project in which they demonstrate the achievement of the ILOs. The thesis is always assessed by the supervisor and a second assessor, based on an assessment form with rubrics. The assessment form consists of four categories: process, presentation, report, and results. According to the panel, the thesis assessment procedure is well set up. The panel is pleased to see that the four eyes principle is applied. The rubrics are clear and extensive. In preparation for the site visit, the panel reviewed a sample of 15 theses from the programme, including the filled-in assessment forms. Similar to the bachelor, the panel agrees with the grades awarded to the theses included in the sample. The grading is transparent and well substantiated with written feedback.

Board of Examiners
There is one central BoE for all bachelor's programmes in UGS and one central BoE for all master's programmes in GSNS. Within each BoE, there are chambers for each (cluster of) programme(s). The chamber chairs have a seat on the central Board. The chambers do most of the daily tasks, such as handling student requests and complaints, and monitoring the quality of assessment. The central Boards appoint examiners and discuss overarching topics and policies. The chambers for the bachelor and master Computer Science are also responsible for the bachelor and master Information Science. Both chambers have three members. The chambers annually review a sample of courses from the programmes. In these reviews, the chambers check the alignment between the ILOs, learning goals, and assessment criteria. They also check if the assessment and grading meet the criteria set in the assessment policy. Besides this, the students' evaluations of the tests are taken into account. All findings are discussed with the involved lecturer and laid down in a report. Each course is reviewed by the chamber every three to four years. For the master, the BoE organizes a thesis intervision each year. The BoE composes an intervision panel that reviews a sample of theses from the master to check if the exit level is demonstrated in the theses, whether the grades given are appropriate, and whether the grading process is transparent. For the Software Project in the bachelor, no such intervision sessions take place. The BoE explained that it does not deem this necessary, given the elaborate intervision and calibration already integrated in the grading procedures of the Software Project.

The panel is very positive about both BoEs (bachelor and master) and the chambers. It considers the BoEs to be independent, competent, in control, and proactive with regard to safeguarding the assessment quality in the programmes. The chambers are closely involved in the day to day processes in the programmes. The panel appreciates the procedures in place to safeguard the quality of assessment, such as the annual reviews of courses and the intervision sessions for master theses. The panel recommends the BoE of the bachelor to implement similar intervision sessions for the bachelor's Software Project. According to the panel, regular external reviews of samples of Software Projects are necessary for the BoE to be able to guarantee the exit level of the bachelor.

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 applied and appropriate measures are taken to improve and ensure the quality of assessment in the programmes, such as the peer-reviews of assessments, the use of assessment matrices, and the use of rubrics. The panel appreciates how the programmes deal with the impact of AI on assessment. The assessment procedure for the bachelor Software Project is adequate and well set up. The panel appreciates the intervision and calibration integrated in the grading process, as multiple lecturers are involved in the grading process. Furthermore, the grading process results in justified individual grades thanks to a careful assessment process throughout the project. The assessment procedure for the master thesis is also adequate, as theses are assessed by two assessors, based on an assessment form including written feedback. The panel considers the BoE of both the bachelor and the master to be independent, competent, in control, and proactive with regard to safeguarding the assessment quality in the programmes. The panel does recommend the BoE of the bachelor to implement regular external reviews of samples of the bachelor's Software Project, possibly similar to the annual intervision sessions for the master theses, in order to guarantee the exit level of the bachelor.

Conclusion

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

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Final student projects

The final student project demonstrates the level achieved by the students. As mentioned earlier, for the bachelor, this concerns the Software Project. In the master, the thesis is the final project. The panel reviewed the products of a sample of five teams (44 students in total) for the Software Project, and a sample 15 theses from the master. The panel concludes that the Software Projects and master theses reflect a level that is appropriate for an academic bachelor's/master's programme. The Software Projects and master theses clearly show that students have achieved the ILOs. According to the panel, the Software Projects demonstrate that students are capable of applying the acquired knowledge and skills in practice while maintaining a high level of abstraction.

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. Many graduates choose to pursue a master's programme, while some start working in positions such as software developer, software engineer, or programmer.

Based on the documentation and the interview with alumni, the panel is positive about how graduates from the master perform in the professional field. They usually find a job relatively easily and work in positions such as software developer, software engineer, data scientist, or game developer. Some students continue in academia in a PhD position. In the interview, alumni indicated that the programme had generally prepared them well for their jobs. They did mention that some particular skills had to be learnt on the job. As this mostly concerns technical skills that are specific to the company, the panel considers this understandable and inevitable.

Considerations

Based on the review of the products of a sample of five teams (44 students in total) from the bachelor Software Project and a sample of 15 theses from the master, the panel concludes that the level demonstrated in the final projects 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 Computer Science meet standard 4.

General conclusion

The panel judges that the bachelor's and master's programme Computer Science meet all four standards. The panel's assessment of the programmes is therefore positive.

Recommendations

Both programmes

1. Further engage the advisory board on a strategic level in a structural way, in order to align the programmes' visions, ILOs, and curricula with developments in the professional field. Make a systematic inventory and analysis of current industry connections, in order to improve coordination on programme level and to identify possible gaps for which additional industry partners need to be engaged. Increase interactions with the professional field in courses, specifically in the GMT and DASC master tracks.
2. Develop a streamlined infrastructure that ensures the required availability of computing services for students in courses as well as the master thesis project.
3. Further strengthen the alignment meetings in the bachelor and implement similar sessions in the master, in order to improve communication among lecturers and alignment across courses.

Bachelor

4. Develop a coherent learning pathway for mathematics that visualizes and makes explicit where the required mathematics is addressed and assessed.

5. Reflect on the attention for academic skills and ethics in the curriculum and consider increasing it as well as developing a clear learning pathway for these skills.
6. Increase the number of full professors who teach in the bachelor.
7. Implement regular external reviews of samples of the Software Project, possibly similar to the annual intervision sessions for the master theses, in order to guarantee the exit level of the bachelor.

Master

8. Improve communication to students about the support available in finding a thesis supervisor.
9. Consider the implementation of intervision groups for students during the thesis project.
10. Explore ways to strengthen the sense of community among all students in the master.

Appendix 1. Intended learning outcomes

Bachelor Computer Science

The graduate of the bachelor Computer Science:

1. Knowledge and understanding:
- has knowledge of and insight into the field of computer science;
- has knowledge of and insight into the theoretical and methodological foundations of computer science;
- possesses general academic skills, particularly in relation to computer science;

2. Applying knowledge and understanding:
- is able to apply knowledge and understanding in such a way that it demonstrates a professional and ethical approach to their work or profession;

3. Judgment:
- can reformulate a practical question or problem in the field of computer science into a clear and researchable problem statement;
- adequately operationalize the concepts contained therein;
- study a subject both theoretically and empirically, in their interrelation;
- present the results in a coherent argument, concluded with a clear, synthesizing conclusion;
- use the results to answer the practical question or to contribute to the clarification and, if possible, the solution of the problem;
- can form a judgment that is also based on the consideration of relevant social, scientific, or ethical aspects;

4. Communication:
- is able to convey information, ideas, and solutions to an audience consisting of specialists or non-specialists;

5. Learning skills:
- possesses the learning skills and competences necessary to pursue a master's degree.

Master Computer Science

Track Computing Science

The graduate:

Knowledge and understanding
- K1. Can use their knowledge of computer science to make a substantial contribution to the development and/or application of scientific concepts and methods, often in a research context.
- K2. Is capable of understanding important recent developments in computer science, and of indicating their implications for society and the research field.
- K3. Is capable of interpreting and using specialized literature in the field of computing science.
- K4. Has insight into integrity related issues in computer science.

Applying knowledge and understanding

- A1. Is capable of translating a problem from the area of computer science or an application into a research question that is relevant to and suited for scientific development, product development or education.
- A2. Is capable of translating this research question into an appropriate research plan in accordance with the required scientific and methodological standards.
- A3. Is capable of independently performing this research with the required care and ethical responsibility and to process, interpret in the appropriate manner.

Making judgments
- M1. Is capable of discussing the outcomes of empirical and theoretical research and to relate them to the current scientific state-of-the-art and literature.
- M2. Is capable of indicating the relevance of this research to the solution of problems in the area of computer science, also from the viewpoint of society wherever possible.
- M3. Has the capability to reflect critically on their own efforts as a researcher in the area of computer science from the viewpoint of society.

Communication skills
- C1. Is capable of clearly communicating the results of research, in writing as well as orally, to an audience of specialists and laymen, in an international context.
- C2. Is capable of functioning effectively in a research team of possibly multi-disciplinary composition.

Learning skills
- L1. Has the capability to evaluate their own learning- and development process during the study, and if necessary to motivate and adjust themselves.
- L2. Has acquired an effective and results-driven way of working that allows them to function independently in a competitive labour market.
- L3. Has the qualification to obtain a PhD position as well as a job in business and industry.
- L4. Has insight into employment opportunities and on the skills needed to make a successful start in the job market.

Track Game and Media Technology

The graduate:

Knowledge and understanding
- Can use their knowledge of computer science and its applications in the field of game and media technology to make a substantial contribution to the development and/or application of scientific concepts and methods, often in a research context.
- Is capable of understanding important recent developments in computer science and its applications in the field of game and media technology, and of indicating their implications for society and the research field.
- Is capable of interpreting and using specialized literature in the field of game and media technology.
- Has insight into the integrity dilemmas that play a role in the field of game and media technology.

Applying knowledge and understanding
- Is capable of translating a problem from the area of computer science and its applications in the field of game and media technology or an application into a research question that is relevant to and suited for scientific development, product development or education.

- Is capable of translating this research question into an appropriate research plan in accordance with the required scientific and methodological standards.
- Is capable of independently performing this research with the required care and ethical responsibility and to process, interpret and evaluate the empirical data and other outcomes thus obtained in the appropriate manner.

Making judgments
- Is capable of discussing the outcomes of empirical and theoretical research and to relate them to the current scientific state-of-the-art and literature.
- Is capable of indicating the relevance of this research to the solution of problems in the area of computer science and its applications in the field of game and media technology, also from the viewpoint of society wherever possible.
- Has the capability to reflect critically on their own efforts as a researcher in the area of computer science, and its applications in the field of game and media technology from the viewpoint of society.

Making judgments
- Is capable of clearly communicating the results of research, in writing as well as orally, to an audience of specialists and laymen, in an international context.
- Is capable of functioning effectively in a research team of possibly multi-disciplinary composition.

Learning skills
- Has the capability to evaluate their own learning- and development process during the study, and if necessary, to motivate and adjust themselves.
- Has acquired an effective and results-driven way of working that allows them to function independently in a competitive labour market.
- Has the qualification to obtain a PhD position as well as a job in business and industry.
- Has a good overview of the opportunities and necessary skills to make a successful transition to the labour market.

Track Data Science

The graduate:

Knowledge and understanding
- Graduates can use their knowledge to make a substantial contribution to the development and/or application of scientific concepts and methods, in Data Science.
- Graduates can understand important recent developments in Data Science, and of indicating their implications for society and the research field.
- Graduates are capable of interpreting and using specialized literature in the field of Data Science.
- Graduates have insight into integrity-related issues related to the application of Data Science for solving business and societal issues.
- Graduates have the foundational knowledge of theories, principles, methods, for data storage, integration, cleaning, understanding, exploration.
- Graduates have in-depth knowledge and understanding of data analytics.
- Graduates are familiar with advanced visualization techniques for massive data presentation, interaction, and analysis.

Applying knowledge and understanding

- Graduates can translate a problem from the area of Data Science or an application into a research question that is relevant to and suited for scientific development, product development or education.
- Graduates can translate a research question into an appropriate research plan in accordance with the required scientific and methodological standards.
- Graduates are capable of independently performing the research with the required care and ethical responsibility and to process, interpret and evaluate the empirical data and other outcomes thus obtained in the appropriate manner.
- Graduates can solve well-defined business problems from an interdisciplinary perspective using data science tools, techniques, and expertise.
- Graduates know how to collect, store, and process datasets to make them ready for exploration and analysis.
- Graduates can apply a broad range of data analytic techniques.

Making judgements

- Graduates can discuss the outcomes of empirical and theoretical research and to relate them to the current scientific Data Science state-of-the-art and literature.
- Graduates can indicate the relevance of their research to the solution of problems in Data Science, also from the viewpoint of society wherever possible.
- Graduates have the capability to reflect critically on his or her own efforts as a researcher in Data Science from the viewpoint of society.
- Graduates can assess the content, context, size, quality, limitations, and potential of datasets for solving a specific challenge at hand.
- Graduates can identify research challenges that can be addressed through the exploitation of specific datasets and the employment of specific Data Science methods.

Communication

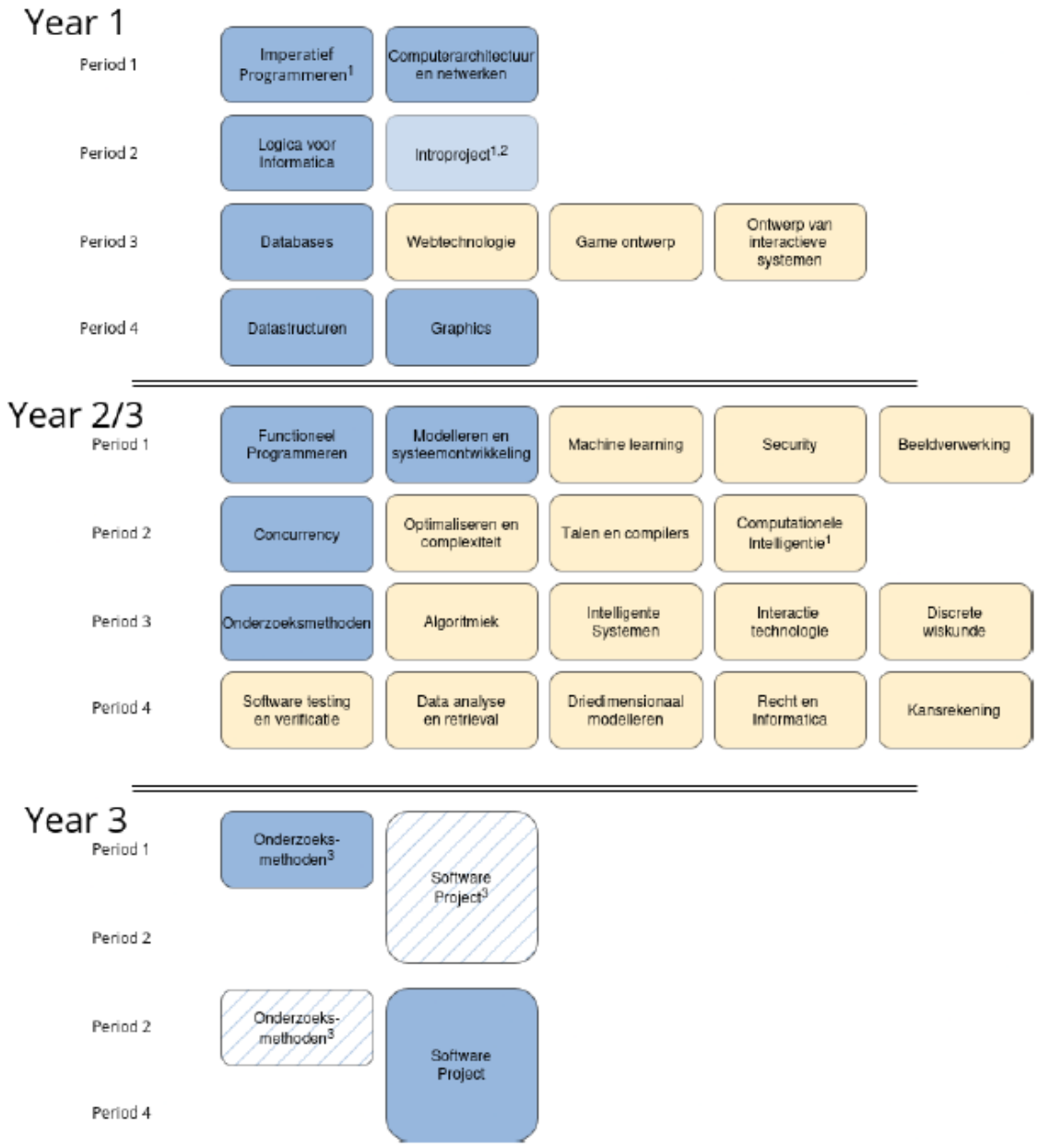
- Graduates are capable of clearly communicating the results of research, in writing as well as orally, to an audience of specialists and non-professionals, in an international context.
- Graduates are capable of functioning effectively in a research team of multi-disciplinary composition.

Learning skills

- Graduates have the capability to evaluate his or her own learning- and development process during the study, and if necessary to motivate and adjust himself or herself.
- Graduates have acquired an effective and result driven way of working that allows him or her to function independently in a competitive labour market.
- Graduates have the qualification to obtain a PhD position as well as a job in business and industry.
- Graduates have insight into employment opportunities and on the skills needed to make a successful start in the job market.

Appendix 2. Programme curriculum

Bachelor's programme



Master's programme

Track Computing Science

COSC	Period 1	Period 2	Period 3	Period 4
Year 1 (60,5 EC)	- GSNS-INTRO (0,5 EC) - Elective (7,5 EC) - Elective (7,5 EC)	- Elective (7,5 EC) - Elective (7,5 EC)	- F1-MHPSDL1 (0 EC) (prep for FI-MHPSDL2) - INFOMSMC (7,5 EC) - Elective (7,5 EC)	- F1-MHPSDL1 (0 EC) (prep for FI-MHPSDL2) - Elective (7,5 EC) - Elective (7,5 EC)
Year 2 (59,5 EC)	- INFOMCCS4 - FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - Elective (7,5 EC) - Elective (7,5 EC)	- INFOMCCS4 - FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - INFOMAI1 project proposal (14 EC)	- FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - INFOMCOSC2 - INFOMAI2 Thesis (30 EC)	- FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - INFOMCOSC2 Thesis (30 EC)

Contents

- Mandatory courses: 23.5 EC
- Primary electives: 22.5 EC
- Secondary electives: 30 EC
- Research part: 44 EC
- Total: 120 EC

Study paths

Students follow 'study paths'. A study path is a coherent set of courses tailored towards a general topic within the master's program. The following study paths (listed below) are pre-defined and set the standard for the program.

- Programming technology
- Algorithm design and analysis
- Operations research

Alternatively, an individual study path can be composed, under approval of the programme leader. The courses that belong to each of the above study paths are listed in the 'Primary electives' section below.

Mandatory courses

- Algorithms for decision support (INFOMADS): 7.5 EC
- Concepts of programming language design (INFOMCPD): 7.5 EC
- Scientific methods for Computing Science (INFOMSMC): 7.5 EC
- Introducing Natural Sciences (GSNS-INTRO): 0.5 EC
- Dilemmas of the scientist (FI-MHPSDL1 + FI-MHPSDL2): 0.5 EC

Primary electives

The primary electives consist of at least three courses from the choice of the core courses defined by the study path chosen by the student. For each of these study paths, their corresponding courses (all are 7.5 EC) are listed below.

- Programming technology, courses:
    - Advanced functional programming (INFOAFP)
    - Language based security (INFOMLBS)
    - Probabilistic Reasoning (INFOPROB)
    - Program semantics and verification (INFOMPSV)
- Algorithm design and analysis, courses:
    - Geometric algorithms (INFOGA)
    - Advanced Algorithms (INFOAN)
    - Scheduling and time-tabling (INFOSTT)
    - Network science (INFOMNWSC)
    - Optimization for sustainability (INFOMOFS)
- Operations research, courses:
    - Optimization for sustainability (INFOMOFS)
    - Scheduling and time-tabling (INFOSTT)
    - Advanced Algorithms (INFOAN)
    - Statistical Learning and Stochastic Processes (INFOMSLSP)
    - Evolutionary Computing (INFOEA)

Secondary electives

Secondary electives can be chosen from the list below:

- Any primary elective from the Computer Science Master's curriculum (including the Game and Media Technology and Data Science programmes), except for those courses that are not open for enrolment by other programs. Check the annex of these programs to verify if your choice of secondary elective is open for enrolment for COSC students.
- An experimentation project of either 7.5 (INFOMEPCS) or 15 EC (INFOMEPCS1).
- A literature study under supervision of a CS staff member (capita selecta) of 7.5 EC.
- Other MSc courses offered by Utrecht University: Multi-agent systems, Multi-agent learning, Natural language processing, or Technologies for Learning. Other courses may also be possible, subject to the approval process described below.
- Courses taken from the Mastermath programme: Continuous optimization, Queueing theory, Parallel algorithms, Algorithms Beyond the Worst Case, Category Theory or Homotopy type theory. Other courses may also be possible, subject to the approval process described below.
- Courses taken offered by the TU Eindhoven as part of the eduXchange, more specifically the courses:
    - Process Algebra, Automatic Theorem Proving, and Proving with Computer Assistance (for students in the Programming Technology study path)
    - Algorithms for Geographic Data, Massively Parallel Algorithms, and Topological Data Analysis (for students in the Algorithm design and analysis study path)

A student may take up other relevant courses outside of the regular Computer Science curriculum, within or outside the UU, upon approval in advance of the programme coordinator and upon request of the student. This choice is subject to approval by the Board of Examiners, who will take into account the advice of the programme coordinator. Of these, 7.5 EC worth of courses can be chosen outside the Faculty of Science.

Research part

The overall research part is split into the following parts:

- Thesis project Part I (INFOMCOSC1): 15 EC

- Thesis project Part II (INFOMCOSC2): 25 EC
- Computing Science colloquium (INFOMCCS4): 4 EC

Track Game and Media Technology

GMTE	Period 1	Period 2	Period 3	Period 4
Year 1 (60,5 EC)	- GSNS-INTRO (0,5 EC) - INFOMSCIP (7,5 EC) - Elective (7,5 EC)	- Elective(7,5 EC) - Elective (7,5 EC)	- F1-MHPSDL1 (0 EC) (prep for FI-MHPSDL2) - INFOMCV (7,5 EC) - Elective (7,5 EC)	- F1-MHPSDL1 (0 EC) (prep for FI-MHPSDL2) - Elective (7,5 EC) - Elective (7,5 EC)
Year 2 (59,5 EC)	- INFOMCGM4 (4 EC) - FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - Elective (7,5 EC) - Elective (7,5 EC)	- INFOMCGM4 (4 EC) - FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - INFOMGMT1 project proposal (15 EC)	- INFOMCGM4 (4 EC) - INFOMGMT2 Thesis (25 EC)	- INFOMCGM4 (4 EC) -INFOMGMT2 Thesis (25 EC)

Contents

- Mandatory courses: 16 EC
- Primary electives: 45 EC
- Secondary electives: 15 EC
- Research part: 44 EC
- Total: 120 EC

Mandatory courses

- Computer Vision (INFOMCV): 7.5 EC
- Scientific Perspectives on GMT (INFOMSCIP): 7.5 EC
- Introducing Natural Sciences (GSNS-INTRO): 0.5 EC
- Dilemmas of the Scientist (FI-MHPSDL1 + FI-MHPSDL2): 0.5 EC

Primary electives

Select out of the following list of courses, amounting to a total of 45 EC:

- AI for game technology (INFOMAIGT): 7.5 EC
- Geometric Algorithms (INFOGA): 7.5 EC
- Advanced Graphics (INFOMAGR): 7.5 EC
- Computer Animation (INFOMCANIM): 7.5 EC
- Physics of Motion (INFOMGP): 7.5 EC
- Multimodal Interaction (INFOMMMI): 7.5 EC
- Mobile Interaction (INFOMMOB): 7.5 EC
- AI-driven Content Generation (INFOMAICG): 7.5 EC
- Optimization and Vectorization (INFOMOV): 7.5 EC
- Crowd Simulation (INFOMCRWS): 7.5 EC

- Multimedia Retrieval (INFOMR): 7.5 EC
- Sound and Music Technology (INFOMSMT): 7.5 EC
- Deep Learning (INFOMDLR): 7.5 EC
- Serious Games (INFOMSEGA): 7.5 EC
- Small Project GMT (INFOMSPGMT): 15 EC

Secondary electives

All courses of the master programs Computing Science, Artificial Intelligence, Data Science, Human Computer Interaction, and Business Informatics, can be followed as secondary elective, except for the ones that are not open for enrolment by other programs. Check the annex of these programs to verify if your choice of secondary elective is open for enrolment for GMTE students.
Other master courses, within or outside the UU, that contribute towards the aim of the program, can be approved by the Board of Examiners upon request of the student. In their decision, the board will take into account the advice of the program coordinator. Note that for courses outside the UU further conditions apply; see art. 3.7 of the main EER text.

Research part

The research part is split into the following courses:

- Game and Media Technology Project Proposal (INFOMGMT1): 15 EC
- Game and Media Technology MSc Thesis (INFOMGMT2): 25 EC
- Colloquium Game and Media technology (INFOMCGM4): 4 EC

Track Data Science

DASC	Period 1	Period 2	Period 3	Period 4
Year 1 (60,5 EC)	- GSNS-INTRO (0,5 EC) - INFOMDM (7,5 EC) - INFOMDIS (7,5 EC)	- INFOMKDE (7,5 EC) - Elective (7,5 EC)	- F1-MHPSDL1 (0 EC) (prep for FI-MHPSDL2) - INFOMSMC (7,5 EC) - Elective (7,5 EC)	- F1-MHPSDL1 (0 EC) (prep for FI-MHPSDL2) - Elective (7,5 EC) - Elective (7,5 EC)
Year 2 (59,5 EC)	- FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - INFOTIMDS (0 EC) - Elective (7,5 EC) - Elective (7,5 EC)	- FI-MHPSDL2 (0,5 EC) (follow-up to F1-MHPSDL1) - INFOMDASC1 project proposal (15 EC)	- INFOMDASC (4 EC) - INFOMDASC2 Thesis (25 EC)	- INFOMDASC (4 EC) -INFOMDASC2 Thesis (25 EC)

Contents

- Mandatory Courses: 30 EC
- Primary Electives: 37.5 EC
- Secondary Elective : 7.5 EC
- Research Introductory Courses : 1 EC
- Research Project Courses : 44 EC
- Total : 120 EC

Mandatory courses

- Data Mining (INFOMDM): 7.5 EC
- Knowledge and Data Engineering (INFOMKDE): 7.5 EC
- Data Intensive Systems (INFOMDIS): 7.5 EC
- Scientific Methods for Computing Science (INFOMSMC): 7.5 EC
- Introducing Natural Sciences (GSNS-INTRO): 0.5 EC
- Dilemmas of the scientist (FI-MHPSDL1 + FI-MHPSDL2): 0.5 EC

Primary electives (7.5 EC each)

- Statistical Learning and Stochastic Processes (INFOMSLSP)
- Advanced Machine Learning (INFOMAML)
- Data Visualization (INFOMDV)
- Information Visualization (INFOMVIS)
- Deep Learning (INFOMDLR)
- Machine Learning in Dynamic Data Environments (INFOMLDDE)
- Network Science (INFOMNWSC)
- Process Mining (INFOMPROM)
- Cloud and Edge Computing (INFOMCEC)
- Algorithmic Data Analysis (INFOMADA)
- Explainable AI (INFOMXAI)
- Human-Centered Machine Learning (INFOMHCML)

Secondary electives

As secondary elective can be considered any master course offered by any department of Utrecht University with at least 7.5 ECTS, that has not been used as mandatory or primary elective and is not intended exclusively for students of some other program as stated in the respective EER annex of that program. Other master courses outside the UU that contribute towards the aim of the program can also be considered. The selection of the course needs to be approved by the Board of Examiners. In its decision, the board will take into account the advice of the program coordinator and the provisions stated about non-Utrecht University courses in the main EER text (see art. 3.7).

Research part

The research project is implemented in two phases:

- Phase 1: The Research Introductory Courses (that includes the Thesis Information Session (INFOMTIMDS)), the Colloquium (INFOMCDASC: 4 EC), and the Project Proposal (INFOMDASC1: 15 EC). The Project Proposal consists of a literature review and a problem specification. The phase ends with a colloquium presentation and a document.
- Phase 2: is devoted to the actual thesis and consists of the Data Science Thesis (INFOMDASC2: 25 EC), which is Research Work, ending with a thesis document and a presentation. It can start only if Part I has been completed.

Appendix 3. Programme of the site visit

Day 1: Monday 6 October 2025

10.30	10.45	Arrival and welcome
10.45	11.15	Private panel meeting
11.15	12.15	Interview programme management
12.15	13.00	Lunch break
13.00	13.40	Interview students BSc
13:50	14:30	Interview students MSc
14.45	15.15	Lab tour
15.15	16.00	Break
16.00	17.00	Interview lecturers BSc + MSc
17.15	18.00	Interview alumni
18.00	18.30	Private panel meeting

Day 2: Tuesday 7 October 2025

08.45	09.15	Panel arrival and preparation
09.15	09.45	Interview Board of Examiners
10.00	12.00	Thematic sessions
12.00	13.30	Private panel meeting (incl. lunch)
13.30	14.00	Final interview management and faculty
14.00	14.45	Private panel meeting: preliminary conclusions, preparation of oral feedback
14.45	15.00	Oral feedback on preliminary conclusions
15:00	15:30	Drinks and Bites

Appendix 4. Materials

Prior to the site visit, the panel studied five group projects from the bachelor's programme (44 students in total) and 15 theses from the master's programme. Information on the projects and theses is available from Academion upon request.

The panel also studied other materials, which included:

General

- Reading guide
- Administrative data
- Organogram and organizational description
- Technical advisory board – agenda
- Utrecht University Educational Model and Vision 2024
- Utrecht University Educational Guideline 2017
- Reports Quality Funds Informatica 2019-2024
- Ethics and Privacy Quick Scan
- Promotion material for collaboration with external parties
- Information on study advisors
- Information on student provisions
- Study spot availability
- UU Start the Teach program for new lecturers
- Guidelines teaching tasks for 5-year PhDs
- UTQ and STQ procedures at the Faculty of Science
- Handreiking verantwoordelijkheden kwaliteit opleidingen
- UU Guideline Generative AI in Education
- Guidelines for course assessment and Generative AI
- Alumni job and employer overview

Bachelor

- SWOT analysis
- Student chapter
- Materials from three selected courses
- Vision
- Information materials from websites, brochures, presentations, and video clips
- Intended learning objectives
- Curriculum mapping to ACM model curriculum
- Information on selective admission
- Intake numbers
- Curriculum overview
- Education and Examination Regulations
- Staff-student Ratio
- Student information on Software Project
- UGS Starter Guide for New Students
- Information on mentorship (tutoraat)
- Student Wellbeing and Awareness
- Overview staff – registered UTQ-STQ

- Reports Education Committee UGS (2020-2024)
- Reports Education Advisory Committee Informatica (2023-2025)
- Caracal evaluations of three selected courses
- Results NSE (2021-2024)
- UGS Toetsbeleidsplan
- Assessment plan
- Assessment of Software Project
- Regulations Board of Examiners
- Yearly reports Board of Examiners (2020-2024)
- Computer Science assessment audits (2020-2024)
- Overview of completed final projects
- Data on outflow and study success
- Graduate survey

Master

- SWOT analysis
- Student chapter
- Materials from three selected courses per track
- Vision
- Information materials from websites, brochures, presentations, and video clips
- Intended learning objectives
- Information on selective admission
- Intake numbers
- Curriculum overview
- Education and Examination Regulations
- Staff-student Ratio
- Information on thesis project procedure
- Internship agreement documents
- Guidance for Research Master thesis students
- GSNS Starter Guide for New Students
- GSNS Welcome booklet
- Information on support and development
- Student Wellbeing and Awareness
- Overview staff – registered UTQ-STQ
- Reports Education Committee GSNS (2020-2024)
- Reports Education Advisory Committee Computer Science (2023-2025)
- Caracal evaluations of three selected courses per track
- Results NSE (2021-2024)
- GSNS Assessment Policy
- Assessment plan
- Thesis assessment forms and rubrics
- Thesis intervision report
- Regulations Board of Examiners
- Yearly reports Board of Examiners (2020-2024)
- Computer Science assessment audits (2020-2024)
- Overview of completed theses
- Data on outflow and study success

- NUFFIC stayrate international graduates
- Thesis fair invitation
- Publications with students
- Graduate survey