academion

M Computational Science (joint degree)

University of Amsterdam

VU University Amsterdam

© 2026 Academion

www.academion.nl
info@academion.nl

Project code P2409

Contents

Summary

Standard 1. Intended learning outcomes

The panel praises the CLS programme for embodying a clear and well-supported vision that addresses the evolving needs of the professional field, and that prepares students for successful careers in research-intensive environments. Its clarity and purpose make the programme distinct, and it pleases the panel to see that the programme can match itself with similar programmes in prestigious international universities. The intended learning outcomes align well with the expectations of a master's degree and with the programme's vision and objectives. They comprehensively cover knowledge, research skills, and professional competencies, and thereby ensure that graduates are well-equipped for both academic and industrial roles in computational science. The orientation towards both academic research and professional application is considered strong by the panel. Continuous input from the professional advisory board and feedback from alumni are strong points and keep the programme attuned to labor market needs. Moving forward, the panel recommends updating the ILOs to reflect recent developments in GenAI, and considering the establishment of a dedicated CLS advisory board.

Standard 2. Teaching-learning environment

The panel is content with the programme's well-structured and flexible curriculum that facilitates the achievement of the intended learning outcomes and is tailored to a diverse student body. The interdisciplinary focus and international orientation of the programme are properly reflected in the admission criteria, curriculum design, and language policy. The panel commends the programme's flexible structure and responsiveness to student feedback, which enables a tailored and engaging learning experience that is highly valued by students. The strong support system, including established provisions for students requiring additional support, add to the accessibility and feasibility of the programme for a broad range of students. The panel is happy to see that instruction is delivered by a qualified research-active teaching staff that actively collaborates in order to provide students with a cohesive educational experience.

The panel appreciates that the joint degree programme is well designed and effectively implemented, with both the UvA and the VU making significant contributions to the curriculum, thesis supervision, and assessment. The collaboration is further strengthened by cohesive governance structures, with representatives from each university and cross-membership on subcommittees, ensuring thorough alignment in intended learning outcomes, quality assurance, regulations, and resources across locations. Moving forward, the programme should increase efforts to enhance the administrative processes and support for students taking courses at the VU.

Standard 3. Student assessment

The panel values the programme's assessment system for being robust and multifaceted, emphasizing validity, reliability, and transparency. The diverse array of assessment methods is tailored to the programme's interdisciplinary and research-oriented nature. The master thesis assessment is detailed and constructive. The programme's proactive stance toward the challenges posed by generative AI underscores its commitment to maintaining academic standards and assessment integrity in a changing educational landscape. The panel recommends continuous attention for clear and uniform procedures to address the use of GenAI, and to maintain a systematic record of all suspicious cases. It pleases the panel to see that the Examinations Board is proactively reviewing all course assessment plans, and that support for the Board has improved.

Standard 4. Achieved learning outcomes

The panel is content to see that the students achieve the intended learning outcomes of the programme. This is evidenced by the quality of the theses and the successful performance of graduates in both professional practice and postgraduate education. It pleases the panel to see that thesis projects are of clear scientific relevance. The alumni of the programme are highly demanded in the professional field and are well-prepared for their jobs, which is a strong indicator of the practical relevance and effectiveness of the education. Moving forward, the panel recommends to strengthen the integration of societal and ethical considerations in the thesis projects.

Score table

The panel assesses the programme as follows:

M Computational 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. ir. Bart Preneel, Panel chair	Dr. Rik Ligthart, Secretary

Date: 16 March 2026

Introduction

Procedure

Assessment

On 26 and 27 November 2025, the joint master's programme Computational Science of the University of Amsterdam (UvA) and the Vrije Universiteit Amsterdam (VU) was assessed by an independent peer review panel as part of the cluster assessment WO Informatica groep 3. The assessment cluster consisted of 25 programmes, offered by the Open Universiteit, Leiden University, the University of Groningen, Utrecht University, Radboud University, Eindhoven University of Technology, Delft University of Technology, Vrije Universiteit Amsterdam, the University of Amsterdam, and the 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). It also followed 'Protocol Joint Degree 2021'.

Quality assurance agency Academion coordinated the assessment upon request of the cluster WO Informatica groep 3. Peter Hildering and Yannick Slagter acted as coordinator in the cluster assessment. Rik Ligthart acted as secretary for the assessment of the programmes of University of Amsterdam. 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 three panel members 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 programme composed a site visit schedule in consultation with the coordinator (see appendix 3). The University of Amsterdam was chosen as the site visit location because the UvA is the coordinating institution of the joint degree. In addition, the VU and UvA site visits were scheduled back-to-back between 24-27 November 2025, with overlapping panels (4 out of 5 panel members), so that the panel could include impressions from both locations in its evaluation of the joint degree. The programmes selected representative partners for the various interviews. It was also determined that the development dialogue would be made part of the site visit. A separate development report was made based on this dialogue.

The programme provided the coordinator with a list of graduates over the period 2023-2025. In consultation with the coordinator, the panel chair selected 15 theses. This selection included theses that were supervised and assessed at both UvA and VU. Prior to the site visit, the programme provided the panel with the theses and the accompanying assessment forms. It 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). Care was taken to ensure that staff from both UvA and VU was present during the sessions. The panel also offered students and staff members an opportunity for confidential discussion during a consultation hour. No consultation was requested. The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the preliminary findings, general observations of the panel and suggestions for development themes.

Report

The secretary wrote a draft report based on the panel's findings and submitted it to the coordinator for peer assessment. Subsequently, the secretary sent the report to the panel for feedback. After processing this feedback, the secretary sent the draft report to the programme 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 at the UvA and the Faculty of Science at the VU.

Panel

The panel assessing the M Computational Science at the UvA and VU consisted of the following members:

- Prof. dr. ir. B. (Bart) Preneel, Full Professor Computer Security and Industrial Cryptography at the Faculty of Engineering, KU Leuven [Chair];
- Prof. dr. M. (Marieke) Huisman, Professor Software Reliability at the Faculty of Electrical Engineering, Mathematics and Computational Sciences at the University of Twente (UT);
- Prof. dr. F. (Fabiano) Dalpiaz, Professor Software Production at the Faculty of Beta Sciences, Utrecht University;
- Em. prof. dr. B. (Bastien) Chopard, Emeritus professor (since 2025) at the Computer Science Department of the University of Geneva;
- I. (Imane) el Caïdi BSc, Master student Computer Science (track Algorithm Design and Analysis & Operations Research at Utrecht University [Student member].

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

Information on the programme

Name of the institution:	University of Amsterdam (UvA)
Address:	Nieuwe Achtergracht 166, 1018 WS, Amsterdam
Website:	www.uva.nl
BRIN-number:	21PK
Status of the institution:	Publicly funded institution

Result institutional quality assurance assessment:	Positive

Name of the institution:	VU
Address:	De Boelelaan 1105, 1081 HV Amsterdam
Website:	www.vu.nl
BRIN-number:	21PL
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive

Programme name:	Computational Science
ISAT number:	65015
Orientation of the programme:	Academic
Level of the programme:	Master (NLQF 7)
Number of credits:	120 EC
Language of instruction:	English
Professional requirements:	No
Joint programme:	Joint degree (UvA and VU)
Location:	Amsterdam
Mode(s) of study:	Fulltime
Assessment group:	Informatica groep 3
Awarded degree:	MSc
Submission date NVAO:	1 May 2026

Description of the assessment

Organization

The master's programme Computational Science (CLS) is offered as a joint degree programme by the University of Amsterdam (UvA) and Vrije Universiteit Amsterdam (VU). The UvA is a publicly funded institution located in Amsterdam. It provides education in computer science, social sciences, humanities, communication and media studies, psychology, law, and economics, hosting a diverse population of over 40,000 students, including a high proportion of international students. Many bachelor's programmes are taught in Dutch, while most master's programmes are delivered in English. The VU is also located in Amsterdam and offers bachelor's, master's, and PhD programs to over 30,000 students. It is a research-intensive university with a large international student community, offering many English-taught programmes. Key research themes include Sustainability & climate, AI & digital innovation, Health & life sciences, and Governance & society.

The collaboration in the joint degree is formalized in a cooperation agreement between both universities, and operationalized in a handbook for use by the programme organization. Both the UvA and the VU contribute to the joint degree programme: teaching staff of both institutions is actively involved in delivering courses and supervising thesis projects. Organizationally, the CLS programme is coordinated by the UvA and is embedded in the organizational structure and quality assurance of the UvA's Faculty of Science (FNWI) It is part of the Graduate School of Informatics (GSI), which encompasses multiple master's programmes focused on informatics. The programme is centered in the Lab42 building, which fosters strong connections with Amsterdam's informatics research ecosystem and emphasizes research-based teaching. Its Programme Committee and Examination Board, which includes representatives from both UvA and VU, are part of the UvA Faculty of Science's organizational structure.

Recommendations previous panel

The previous accreditation panel issued several recommendations for the programme. The panel recommended the programme, among others, to strengthen research skills training throughout the curriculum, to address the number of staff in times of growing student numbers, and to enhance the attractiveness of courses for all students. The panel finds that these advices have been considered carefully, leading to further improvement of the programme. See, for further discussion, the respective sections in the report on these topics.

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

Vision and intended learning outcomes

The vision of the CLS master encompasses educating experts in the field of computational science, particularly focusing on the modelling and simulation of complex natural or man-made systems. This multidisciplinary field leverages advanced computing techniques to address and solve intricate problems, often requiring extensive computational resources, such as supercomputers. The programme is strongly rooted in research activities conducted within the participating institutes and research groups, providing students with practical experience and opportunities to engage in cutting-edge scientific projects. Its

emphasis on independent, research-oriented learning is intended to equip students with the skills needed to pursue original research and contribute meaningfully to their fields. The programme is unique in the Netherlands as an independent master's degree fully dedicated to computational science with a computing-centric approach. Internationally, the programme aligns well with comparable programmes in Europe and the USA, covering core topics such as modelling and simulation, scientific computing, and high-performance computing.

The programme aims to provide graduates with a strong foundation in core computational science theory, methodologies, and skills, including modelling and simulation, numerical techniques, and data analysis. Graduates are expected to possess thorough knowledge of modelling and simulation of complex systems and computational methodologies applicable across diverse fields such as physics, biology, medical sciences, and psychology. The programme prepares students for entry into PhD programmes or research positions outside academia. This focus is driven by the growing demand for computationally trained researchers in academia, research labs, and businesses worldwide.

The intended learning outcomes (ILOs) of the programme are aligned with the Dublin descriptors and mapped to the Dutch Qualifications Framework (NLQF), in order to reflect the level and academic orientation expected of a master of science degree. Key competencies include the ability to contribute to scientific research using computational approaches, to formulate and solve problems through abstraction and modelling, and to communicate effectively both orally and in writing. The programme emphasizes scientific research skills, problem-solving abilities, and communication and collaboration skills as they are essential for pursuing PhD studies or engaging in research-oriented professional roles.

Based on the documentation and discussions during the site visit, the panel recognizes the programme as uniquely positioned within the Netherlands, with a clear focus on computing, research, and interdisciplinary collaboration, and by integrating computing-centric approaches with diverse scientific domains. The vision of the programme is clear, well explained, and meaningful as it responds to educational needs in research and various professional sectors. Regarding the level and orientation of the programme, the panel finds that the ILOs emphasize both academic and professional requirements, and that they are demonstrably aligned with the Dublin descriptors at NLQF level 7. The ILOs emphasize important skills such as analytical problem-solving, interdisciplinary attitudes, scientific autonomy, and critical thinking. The creation of an internationally acknowledged reference framework for positioning the programme, could help the programme in its future development, and the panel encourages the programme to take up this challenge.

The panel notes that while the programme recognizes the importance of emerging topics such as the impact of GenAI, this area has not yet been fully integrated into the learning outcomes. Therefore, the panel recommends updating the ILOs in view of GenAI developments. This will ensure that the curriculum remains relevant and prepares students for emerging industry demands. The panel believes that, with the expertise of the teaching staff, the programme could be a university forerunner in shaping the future of computer science education in the light of GenAI.

Role of the professional field

The panel finds that the programme maintains strong ties to the professional field, among others through an active advisory board (which includes a CLS alumnus) and a robust alumni network. The ILOs of the programme are guided by key international reports highlighting the high demand for computational science skills in academia and industry, particularly in simulation-based engineering and high-performance computing. While there is no formal international subject-specific reference framework, the programme benchmarks itself against authoritative reports and literature in the field.

The panel acknowledges that the professional field is actively engaged with the programme through an alumni network and a professional advisory board. These provide valuable input to the programme's development and helps the programme maintain relevance and responsive to societal and industry needs. Currently, the programme benefits from an advisory board at the Graduate School Informatics level. The panel recommends considering the establishment of a dedicated advisory board specifically for the CLS programme. This board ideally would include representatives from academia, industry, and alumni to provide targeted, ongoing guidance aligned with the programme's unique interdisciplinary profile and evolving professional field requirements.

Considerations

The panel praises the CLS programme for embodying a clear and well-supported vision that addresses the evolving needs of the professional field, and that prepares students for successful careers in research-intensive environments. Its clarity and purpose make the programme distinct, and it pleases the panel to see that the programme can match itself with similar programmes in prestigious international universities. The intended learning outcomes align well with the expectations of a master's degree and with the programme's vision and objectives. They comprehensively cover knowledge, research skills, and professional competencies, and thereby ensure that graduates are well-equipped for both academic and industrial roles in computational science. The orientation towards both academic research and professional application is considered strong by the panel. Continuous input from the professional advisory board and feedback from alumni are strong points and keep the programme attuned to labor market needs. Moving forward, the panel recommends updating the ILOs to reflect recent developments in GenAI, and considering the establishment of a dedicated CLS advisory board.

Conclusion

The panel concludes that the programme meets 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

The CLS master is a two-year programme encompassing 120 EC. The curriculum is designed to be flexible and interdisciplinary, and to reflect the broad application of computational science. It consists of mandatory core courses (66 EC, including a 42 EC graduation project), restricted-choice elective courses (30 EC), and free-choice electives (24 EC). The core courses provide essential knowledge in modelling, simulation, and computing. These provide students with a theoretical and practical basis, covering both technical skills and transferable research competencies such as academic writing, ethics, and the use of generative AI tools. The restricted-choice electives help students gain a well-rounded understanding of advanced computational science topics while allowing some degree of personal specialization. Students select six courses from a predefined list of thirteen specialized courses, which expose students to diverse topics such as Data Mining Techniques, Distributed Algorithms, Computational Finance, and Evolutionary Computing. The free electives offer students the freedom to tailor their learning trajectory towards specific application domains that align with their interests and career goals. These electives can be chosen from a broad spectrum of fields, including biology, finance, physics, sociology, and the humanities. This flexibility supports interdisciplinary

learning and enables students to apply computational science techniques in various real-world contexts. It also facilitates students in preparing adequately for their graduation project in a specialized applied field.

During the first year, students typically take two courses per 8-week block. The 4-week blocks are often used for intensive project and practical courses such as Agent-Based Modelling and Complex System Simulation, which emphasize hands-on experience and research skills development. The second year starts with elective courses and culminates in a substantial graduation (thesis) project. The graduation project spans approximately seven months of full-time, independent research, during which students apply their accumulated knowledge and skills to conduct original research. The research is carried out in collaboration with faculty members, research institutes, or external organizations. The graduation project is a critical component in training students for research careers or advanced professional roles, and demands the demonstration of competencies such as problem formulation, data analysis, scientific communication, and ethical reflection.

Based on the documentation and discussions during the site visit, the panel finds that the intended learning outcomes are adequately translated into curriculum components. The curriculum is recognized as a high-quality, valuable offering. Featuring only four core courses, the curriculum gives students significant flexibility and allows them to tailor their learning experience effectively. Important skills such as analytical problem-solving, interdisciplinary attitude, scientific autonomy, and critical thinking are central and well developed throughout the curriculum. The curriculum balances theoretical competencies with practical problem-solving skills through courses and a substantial graduation project. The structure into 8-week or 4-week teaching blocks enables students to concentrate on specific topics and engage in different learning activities. It is clear to the panel that students value the curriculum. Students particularly value the development of software developer skills and the opportunity to enhance their competencies through challenging assignments, which often require independent problem-solving. Also, they appreciate the interdisciplinary group projects that foster collaboration among peers from diverse academic backgrounds, as well as the active improvement of courses based on student feedback.

One of the recommendations from the previous site visit was to strengthen research skills training across the curriculum. The programme responded adequately to this recommendation, among others by introducing a mandatory academic skills course in the first semester, and by offering an optional academic writing module for improving language skills. Moving forward, the panel believes that the emphasis on societal and ethical aspects within the curriculum could be increased. Therefore, the panel suggests to strengthen the integration of societal and ethical considerations throughout the curriculum, with particular attention to embedding these aspects explicitly in the graduation project.

Admission requirements and language
The programme embraces a broad (international) intake from various scientific disciplines to facilitate a rich, interdisciplinary learning environment. It is open to students holding an academic bachelor's degree in one of the Sciences or Engineering disciplines. Prospective students need to demonstrate sufficient knowledge in mathematics, modelling and simulation, and computing skills before admission. This includes basic programming in any language, calculus, and basic knowledge of probability theory and statistics, which is verified through grade transcripts. Students must also demonstrate English proficiency. The programme maintains flexibility by considering students who slightly deviate from these requirements if they show strong motivation and grades. Candidates undergo an intake session following a self-assessment survey, which help identify knowledge gaps and recommend preparatory material.

The programme name and language of instruction are English, consistent with the Faculty of Science and Graduate School of Informatics. This choice aligns with the international nature of scientific research and the global professional environment. All lecturers are active researchers publishing and presenting in English, and English is the working language in all the research groups associated with the programme.

The panel believes that the programme applies clear and realistic admission requirements that reflect the multidisciplinary nature of the field. The programme's management demonstrates a clear awareness of the various backgrounds of admitted students. To address this diversity, the programme offers a minor at the bachelor level, a pre-master option, tutoring in mathematics and programming, and English language tests. These measures reflect the programme's commitment to maintaining a suitable entry level for all students, and adequately preparing students for the programme's demands. Also, the programme offers advanced elective courses to challenge high-achieving students. The panel finds the programme's use of English as the sole language of instruction, and its English name, justified by its international scope and orientation, and the limited availability of similar programmes worldwide. The teaching staff is proficient in English, able to provide effective communication and high-quality instruction.

Learning environment

The programme fosters an environment of independent supervised learning, which encourages students to take ownership of their education while providing significant support, especially in the early stages, through dedicated tutoring in mathematics and programming. The teaching combines lectures and practical lab sessions. The expected weekly workload for students is approximately 40 hours. Students benefit from access to facilities such as the Canvas electronic educational platform, and the Lab42 building. The building has modern and well-equipped teaching rooms. Students are guided and supervised by a dedicated study adviser, who supports students in practical matters related to study planning, course selection, and personal issues that may affect study progress. The study adviser plays a key role in helping students draw up study plans, improving study skills, and making individual arrangements in cases of illness or personal problems. Additionally, the programme has a programme coordinator and other support staff to help students navigate their studies. Information provision to students is supported through various channels. This includes the use of Canvas, which offers structured access to teaching materials. Students also have access to recorded lectures and blended learning tools, which have become standard practice following the Covid-19 pandemic.

Graduation rates within 36 to 48 months vary between approximately 50% and 69%. Dropout rates have been a concern for the programme. Dropout rates are around 16% to 34% over recent cohorts, but these are partly influenced by administrative issues such as students enrolling in multiple master programmes simultaneously. The programme is exploring innovative assessment models to improve feasibility, such as adaptive difficulty assessments, which may help reduce dropout rates and improve on-time graduation.

For students with additional support needs, the programme benefits from the university's student counsellors who assess individual requirements such as dyslexia, neurodiversity, or physical impairments. Advice or guidance provided by a student counsellor are coordinated with the programme to provide appropriate accommodations. Customized solutions are available for non-standard cases, and the university offers facilities like quiet rooms and contemplation rooms to support students' well-being. A faculty coordinator for study facilities has been appointed to better organize complex support needs.

Based on the documentation and discussions during the site visit, the panel finds that the programme offers students an inspiring learning environment. The programme provides a solid support structure, that has evolved over time, to meet student needs. The availability of a study adviser indicates a commitment to strong student support. Facilities and support for students with special needs are adequate, with specific

provisions in place to support students with impairments. The information provision to students is embedded within the programme's organization.

The panel understands that the relatively low graduation rates are partially due to administrative issues (such as students switching to another master programme, or following two programmes simultaneously). Students recognize the programme as demanding yet rewarding, encouraging hard work and intellectual growth. The panel also finds that the programme undertakes action to improve graduation rates. The programme considers implementing innovative flexible assessment models with adaptive difficulty, moderate-difficulty tests, portfolios, and project-based evaluations. The panel endorses these measures.

During the site visit, the panel discussed the design and implementation of the joint degree on several occasions and also reviewed the joint degree agreement signed by the two participating universities. It concludes that the joint degree is well designed and implemented. Each university has a significant contribution to the curriculum, which was evident to the panel in the content and associated staff of the various courses. Both universities offer thesis projects, and staff from both universities is involved in the supervision and grading of theses. The Programme Committee as well as the Examinations Board consists of representatives from each university, which ensures short lines of communication in the alignment of rules and regulations. Additionally, the Examinations Board subcommittee includes a member from the VU committee who is also a member of the UvA Examinations Board subcommittee.

The panel came to understand that, sometimes, students experience administrative difficulties while enrolling in courses at the VU, due to differences in systems and procedures between the two universities. Course registrations for VU and UvA courses are currently managed independently. Although efforts are made to minimize travel time by scheduling UvA courses on specific days and VU courses on other days, the two universities have separate systems and procedures for course registration. The panel recommends to enhance the administrative processes and support for students taking courses at VU, aimed at minimizing bureaucratic hurdles and improving communication towards students. This would facilitate seamless cross-university course enrollment and a smoother learning experience.

Teaching staff

The teaching staff comprises lecturers employed by the research institutes of UvA and VU. They are active researchers involved in top international research, who therefore can deliver research-driven education that is up-to-date with current scientific developments. The teaching staff at both universities teach courses, supervise thesis projects, and contribute to the curriculum. At the UvA, there are 21 teaching staff members involved in the programme, including eight full professors, four associate professors, and six assistant professors. The staff members contribute to the programme for a total of 3.5 FTE. At the VU, there are 32 teaching staff members, contributing 7.5 FTE. This includes eight full professors, four associate professors, and nine assistant professors. All teaching staff hold a PhD degree, and all have or are pursuing a University Teaching Qualification (UTQ). New teachers are required to complete the UTQ within the first two years of their appointment. The programme has managed student-staff ratios by hiring additional faculty and teaching assistants, particularly to support practical sessions and supervision of graduation projects.

Based on the documentation and discussions during the site visit, the panel asserts that the teaching staff is of high quality, and highly motivated to support students in their learning process. The team possesses strong interdisciplinary expertise, which makes for a positive contribution to the students' learning environment. The teaching staff actively engages in continuous collaboration and communication, including joint meetings between UvA and VU staff. During the previous site visit, the panel raised concerns about maintaining a sufficient staff-student ratio given increasing enrolments. The panel finds that the programme

has addressed this issue adequately, among others by hiring 7 new full-time faculty at the UvA and 1 at the VU, and by hiring additional teaching assistants for practical sessions.

The panel sees that the teaching staff composition is diverse but still male-dominated, which reduces the presence of female role models that are crucial for attracting and retaining female students. Female visibility among lecturers, especially in core courses and leadership roles, remains limited. The programme could actively recruit and support female academic staff, encourage female faculty to take visible teaching and coordination roles, and promote their achievements in university events and communications, to foster an inclusive environment and inspire female students.

Considerations

The panel is content with the programme's well-structured and flexible curriculum that facilitates the achievement of the intended learning outcomes and is tailored to a diverse student body. The interdisciplinary focus and international orientation of the programme are properly reflected in the admission criteria, curriculum design, and language policy. The panel commends the programme's flexible structure and responsiveness to student feedback, which enables a tailored and engaging learning experience that is highly valued by students. The strong support system, including established provisions for students requiring additional support, add to the accessibility and feasibility of the programme for a broad range of students. The panel is happy to see that instruction is delivered by a qualified research-active teaching staff that actively collaborates in order to provide students with a cohesive educational experience.

The panel appreciates that the joint degree programme is well designed and effectively implemented, with both the UvA and the VU making significant contributions to the curriculum, thesis supervision, and assessment. The collaboration is further strengthened by cohesive governance structures, with representatives from each university and cross-membership on subcommittees, ensuring thorough alignment in intended learning outcomes, quality assurance, regulations, and resources across locations. Moving forward, the programme should increase efforts to enhance the administrative processes and support for students taking courses at the VU.

Conclusion

The panel concludes that the programme meets standard 2.

Standard 3. Student assessment

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

Findings

System of assessment

The assessment and examination procedures of the programme are governed by the Teaching and Examination Regulations (TER), which are updated annually. The regulations consist of two parts: a faculty-wide part and a programme-specific part. This dual structure ensures that general regulations and specific programme needs are both adequately addressed. Complementing the TER are the Faculty of Science's Assessment Quality Assurance Plan and the Graduate School of Informatics (GSI) Assessment Plan, which together provide comprehensive quality control mechanisms. The assessment methods are designed to align closely with the intended learning outcomes, and to support students' learning processes. For instance, knowledge and understanding are assessed through advanced coursework and independent research projects; application of knowledge is practiced in multidisciplinary contexts; and communication skills are

developed through presentations and scientific writing throughout the curriculum. The programme employs a diverse range of assessment types to capture the multifaceted competencies required in computational science. Next to written exams, assessment includes project reports, programming assignments, oral presentations, and class participation assessments. Homework and practical assignments, often involving programming or data analysis, support incremental learning and skills development throughout the courses.

The graduation project constitutes a central and substantial part of the assessment system, and spans seven months of full-time research. This individual research project is supervised daily by a mentor and assessed by a thesis committee comprising at least three members: the daily supervisor, a second reader, and an examiner appointed by the Examinations Board. The examiner holds ultimate responsibility for the final grade, which is based on a comprehensive evaluation of the research process, the scientific quality of the written thesis, and the oral defence. The assessment employs a digital rubric within the DataNose system to facilitate standardized, criterion-based feedback across key dimensions such as initiative, independence, originality, clarity, and structure. The completed assessment and comments are shared openly with the student.

All graduation projects are assessed under the procedures of the UvA. Students conduct their research often within existing research projects at either the UvA or the VU, or at external institutions. The final grading responsibility lies with an examiner from the programme (typically affiliated with the UvA), and follows a unified procedure under UvA's Examinations Board. To maintain consistency between the two institutions, the Examinations Boards of the UvA and the VU coordinate regularly at central, faculty, and subcommittee levels.

Regarding the role of GenAI, the programme acknowledges the transformative potential of this technology in education while being mindful of associated risks. The UvA has developed a policy framework guiding the deliberate and thoughtful integration of AI tools in education, and the Faculty of Science is actively developing faculty-specific policies. Within the CLS programme, AI and GenAI are not only taught as tools but are also subjects of research and development, reflecting the programme’s research-based teaching philosophy. GenAI has already been incorporated into curricula and courses, in order to prepare students for critical and competent engagement with this emerging technology. The programme plans to incorporate AI-driven tutoring systems to provide students with continuous feedback and support.

The panel came to understand that the UvA and the Faculty of Science have had a conservative approach toward GenAI in education. Recent developments show a more proactive stance, including pilot projects, policy frameworks, and the rollout of GenAI services such as the UvA Chat. The programme is engaging with the challenges and opportunities posed by generative AI in assessment through updating assessment policies and guidelines and through researching assessment implications. This reflects an understanding that the programme must adapt its assessment practices to maintain validity and reliability in the context of emerging AI technologies. The panel encourages the programme to continue working on clear and uniform procedures to address the use of GenAI. Additionally, maintaining a systematic record of all suspicious cases of fraud or plagiarism could strengthen academic integrity controls.

Based on the documentation and discussions during the site visit, the panel recognizes that the programme employs a robust and well-structured system of student assessment that supports the students’ learning process. The panel recognizes that the programme has incorporated varied and standard assessment methods including oral, written, and practical examinations, which contribute to the validity and reliability of the assessment processes. The use of these diverse methods ensures that students are evaluated comprehensively on knowledge and skills relevant to computational science. The thesis assessment and

grading are governed by UvA procedures with strong coordination between both institutions, which ensures consistency in supervision and evaluation.

Before the site visit, the panel reviewed fifteen thesis assessments. The panel considers the thesis assessment procedure to be thorough and careful. The assessment forms demonstrate good substantiation of the assigned grades, and the panel largely concurred with the grades awarded. The master thesis rubric is of good quality and detailed. This supports a thorough and transparent evaluation of student performance. The responsibility for grading lies with the examiner, which is appreciated by the panel as this approach promotes accountability. The panel highlights that while the final thesis grades are derived from the rubric, it questions whether the strict numerical computation currently applied, is always necessary.

The panel observes that course evaluations and feedback mechanisms are used by the programme, yet sometimes students would like more timely or transparent feedback on assignments and exams. The panel suggests to better equip and support teaching staff in providing clear and timely feedback to students. Establishing shared best practices and intensified training for lecturers and teaching assistants could help close the feedback loop and enhance the students' learning experience.

Examinations Board

There is a faculty-wide Examinations Board at the Faculty of Science that oversees the quality of examinations and thesis projects for all programmes within the faculty. Within this faculty-wide board, there are subcommittees for individual programmes, including CLS. The Examinations Board for CLS is part of a joint committee together with the bachelor's programme Informatica. It consists of four members (including a member from the VU), who meet at least once a month. Tasks include overseeing the appointment and competence of examiners, ensuring consistency in grading, and handling formal objections or cases of academic misconduct such as fraud or plagiarism in accordance with university guidelines. The Examinations Board conducts quality assurance audits of courses and randomly selected theses to monitor assessment practices, and it provides feedback for continuous improvement. To synchronize policies between the UvA and VU, regular discussions take place at central, faculty, and subcommittee levels.

The panel finds that the Examinations Board for CLS fulfils its legal duties in a professional manner and is functioning effectively. It functions well and possesses the appropriate expertise to oversee the quality and fairness of assessments across the programme effectively. Support from teaching staff and course coordinators was suboptimal, but has improved over the years, among others by conducting systematic course evaluations. This has led to better detection and resolution of issues during courses. The Examinations Board demonstrates a commitment to maintaining assessment quality, actively reviewing all course assessment plans, taking into account the opportunities and pitfalls of GenAI. The panel advises the Board to set clear and uniform procedures for GenAI-based fraud and to keep track of all suspicious cases.

Considerations

The panel values the programme's assessment system for being robust and multifaceted, emphasizing validity, reliability, and transparency. The diverse array of assessment methods is tailored to the programme's interdisciplinary and research-oriented nature. The master thesis assessment is detailed and constructive. The programme's proactive stance toward the challenges posed by generative AI underscores its commitment to maintaining academic standards and assessment integrity in a changing educational landscape. The panel recommends continuous attention for clear and uniform procedures to address the use of GenAI, and to maintain a systematic record of all suspicious cases. It pleases the panel to see that the Examinations Board is proactively reviewing all course assessment plans, and that support for the Board has improved.

Conclusion

The panel concludes that the programme meets standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Thesis

The panel studied a selection of theses from the period 2023-2025. The selection included theses that were supervised and assessed at the UvA as well as the VU. The panel considers the quality of the theses to be good, and asserts that students achieve the intended learning outcomes of the programme. Theses reflect the programme's focus on research and interdisciplinary collaboration, with about fifteen percent of the theses leading to publications. The topics chosen align well with the programme's objectives, and often involve academic research groups or advanced applications in multidisciplinary fields. The theses demonstrate a sound command of both theoretical and practical computational science concepts. The panel sees an opportunity to improve the societal and ethical reflections in theses, for instance by explicitly incorporating these dimensions into the master thesis requirements.

Performance of graduates

The programme tracks alumni via traditional means and a lively LinkedIn community, annual feedback surveys, and alumni events. The programme's graduates demonstrate high employability in academia and industry. Their skill set is in high demand in commercial sectors, with many graduates moving to prominent companies such as Google, KPMG, and ING. Examples of alumni roles include PhD positions, treasury analysts, machine learning engineers, software developers, and data specialists.

Based on the documentation and discussions during the site visit, the panel finds that graduates are well-prepared for diverse career paths. Alumni express a strong appreciation for the interdisciplinary nature of the programme, which allows them to work on diverse and stimulating topics. They feel well-prepared for demanding future jobs due to the comprehensive and flexible curriculum. Alumni also highlight the high quality and expertise of the teaching staff, which significantly contributes to their learning experience. Additionally, they value the substantial thesis project, which they recognize as a crucial and rewarding component that deepens their research skills and readiness for professional or academic careers.

Considerations

The panel is content to see that the students achieve the intended learning outcomes of the programme. This is evidenced by the quality of the theses and the successful performance of graduates in both professional practice and postgraduate education. It pleases the panel to see that thesis projects are of clear scientific relevance. The alumni of the programme are highly demanded in the professional field and are well-prepared for their jobs, which is a strong indicator of the practical relevance and effectiveness of the education. Moving forward, the panel recommends to strengthen the integration of societal and ethical considerations in the thesis projects.

Conclusion

The panel concludes that the programme meets standard 4.

General conclusion

The panel judges that the master's programme meets all four standards. The panel's assessment of the programme is therefore positive.

Recommendations

1. Update the intended learning outcomes in view of GenAI developments.
2. Consider the establishment of a dedicated advisory board specifically for the CLS programme.
3. Strengthen the integration of societal and ethical considerations throughout the curriculum, with particular attention to embedding these aspects explicitly in the master thesis projects.
4. Enhance the administrative processes and support for students taking courses at VU.
5. Continue working on clear and uniform procedures to address the use of GenAI, and maintain a systematic record of all suspicious cases of fraud or plagiarism.

Appendix 1. Intended learning outcomes

Programme objectives

The objectives of the master's programme Computational Science at the University of Amsterdam are as follows:

1. To educate students at an academic level to the degree of Master of Science in Computational Science, in order to become active members of the scientific research community in academic institutions as well as in advanced research and development environments.
2. To attain a final level of knowledge and academic skills that will grant access to PhD programmes in the Computational Sciences or other scientific research-oriented positions.

Exit qualifications

The exit qualifications of the master's programme Computational Science are defined as follows:

1. The graduate in Computational Science has a thorough knowledge of modelling and simulation of complex systems, computational methods and techniques and the application of computational methodologies in application fields (ranging from e.g. physics or biology to medical sciences or psychology).
2. The graduate is able to contribute to scientific research in the field of the degree course.
3. The graduate can formulate and solve problems with the aid of abstraction andmodel forming.
4. The graduate is able to formulate problems both in general terms and in mathematical and technical terms.
5. Graduates are able to clearly express themselves both orally and in writing.
6. The graduate is able to analyse, design and implement as part of a team.
7. The graduate has given thought to the social context of the exercise of science in general and the application of computer science in particular.
8. The graduate is able to independently acquire the information and concepts that are necessary when starting up a new project.

Appendix 2. Programme curriculum

	Curriculum Master Computational Science 2023-2024											
	Semester 1						Semester 2					
	block 1		block 2		block 3		block 4		block 5		block 6	
	September	October	November	December	January		February	March	April	May	June	
Compulsory Core Courses (year 1) **30 EC**	Introduction to Computational Science (UvA) 6EC		Numerical Algorithms (UvA) 6EC		Complex System Simulation (UvA) 6EC						Agent-Based Modelling (UvA) 6EC	
	Academic Skills Computational Science (UvA) 6EC											
Restricted-Choice Elective Courses (year 1 and 2) **24 EC**	Evolutionary Computing (VU) 6EC		Performance of Networked Systems (VU) 6EC		Biosystems Data Analysis (UvA) 6EC		Computational Finance (UvA) 6EC		Computational Biology (UvA) 6EC			
	Programming Large-scale Parallel Systems (VU) 6EC		Stochastic Simulation (UvA) 6EC				Experimental Design and Data Analysis (VU) 6EC		Data Mining Techniques (VU) 6EC			
							Scientific Computing (UvA) 6EC		Distributed Algorithms (VU) 6EC			
Free-Choice Elective Courses (year 1 and 2) **24 EC**	Bioinformatics I (UvA) 6EC		Advanced Computer Networks (VU) 6EC		Non-equilibrium Statistical Physics (UvA) 3EC		CED 2: Optimal Control and Environmental Tipping (UvA) 5EC		Bioinformatics for Translational Medicine (VU) 6EC		Advanced Computational Condensed Matter (UvA) 3EC	
	From Physics to Physiology (VU) 6EC		Advanced Topics in Computational Finance (UvA) 6EC		Parallel Programming Practical (VU) 6EC		Parameter Estimation Applied to Medical & Biological Science (VU) 6EC		Bioinformatics II (UvA) 6EC		Machine Learning for the Quantified Self (VU) 6EC	
	Fundamentals of Bioinformatics (VU) 6EC		Algorithms in Sequence Analysis (VU) 6EC		Understanding Molecular Simulation (UvA) 6EC				Biomolecular Simulations (UvA) 6EC			
	Machine Learning 1 (UvA) 6EC		CED 1: Learning, Stability and Chaos (UvA) 5EC						Game Theory (UvA) 6EC			
	Non-equilibrium Statistical Physics (UvA) 3EC		Computational Social Choice (UvA) 6 EC						Theory of Complex Systems (UvA) 6EC			
			Distributed Systems (VU) 6EC									
	Numerical Linear Algebra (UvA) 8EC											
	Physics of Complex Systems: Dynamics and Chaos (UvA) 3EC		Scientific Visualization and Virtual Reality (UvA) 6EC									
			Statistical Theory of Complex Molecular Systems (UvA) 6EC									
			The Social Web (VU) 6EC									
	Uncertainty Quantification (UvA) 6EC											
Mandatory Courses (year 2) **42 EC**			Master Thesis Computational Science (UvA) 42 EC									

	Specialisations in the Master Computational Science 2023-2024											
	Semester 1						Semester 2					
Application domain	block 1		block 2		block 3		block 4		block 5		block 6	
	September	October	November	December	January		February	March	April	May	June	
Computational Science Core	Machine Learning 1 (UvA) 6EC		Advanced Computer Networks (VU) 6EC				Experimental Design and Data Analysis (VU) 6EC				Machine Learning for the Quantified Self (VU) 6EC	
			The Social Web (VU) 6EC									
Computational Finance / Economics *Drona Kandhai*			Advanced topics in Computational Finance (UvA) 6EC				CED 2: Optimal Control and Environmental Tipping (UvA) 5EC					
			CED 1: Learning, Stability and Chaos (UvA) 5EC				Computational Finance (UvA) 6EC					
							Stochastic Calculus (UvA) 5EC					
Computational Biology *Jaap Kaandorp*	Bioinformatics I (UvA) 6EC		Algorithms in Sequence Analysis (VU) 6EC						Bioinformatics II (UvA) 6EC			
	Fundamentals of Bioinformatics (VU) 6EC								Bioinformatics for Translational Medicine (VU) 6EC			
Computational Biomedicine *Gábor Závodszky*	From Physics to Physiology (VU) 6EC						Parameter Estimation Applied to Medical & Biological Science (VU) 6EC		Biomolecular Simulations (UvA) 6EC			
	Uncertainty Quantification (UvA) 6EC											
Computational Chemistry and Physics *Edan Lerner* and *Peter Bolhuis*	Non-equilibrium Statistical Physics (UvA) 3EC		Statistical Theory of Complex Molecular Systems (UvA) 6EC		Understanding Molecular Simulation (UvA) 6EC				Biomolecular Simulations (UvA) 6EC		Advanced Computational Condensed Matter (UvA) 3EC	
	Physics of Complex Systems: Dynamics and Chaos (UvA) 3EC											
High Performance Computing *Henri Bal*	Programming Large-scale Parallel Systems (VU) 6EC		Distributed Systems (VU) 6EC									
Computational Social Science *Vitor Vasconcelos and Debraj Roy*			Computational Social Choice (UvA) 6EC						Game Theory (UvA) 6 EC			
			Stochastic Simulation (UvA) 6EC						Theory of Complex Systems (UvA 6 EC			
Sci. Computing / Numerical Math *Daan Crommelin*	Numerical Linear Algebra (UvA) 8EC											
	Uncertainty Quantification (UvA) 6EC						Scientific Computing (UvA) 6EC					
	Course choices in consultation with the specialisation coordinator											
Complex Systems *Rick Quax*	Physics of Complex Systems: Dynamics and Chaos (UvA) 6EC		Stochastic Simulation (UvA) 6EC									
									Theory of Complex Systems (UvA) 6EC			

Appendix 3. Programme of the site visit

Wednesday 26 November

09.30-10.00	Welcome
10.00-10.30	Preliminary discussion panel
10.30-11.30	Programme management BSc Informatica, MSc Computational Science, MSc Software Engineering
11.30-12.15	Interview BSc Informatica students and alumni
12.15-13.15	Lunch
13.15-14.00	Interview BSc Informatica teaching staff
14.00-14.30	Internal deliberation panel
14.30-15.15	Interview MSc Computational Science students and alumni
15.15-16.00	Interview MSc Computational Science teaching staff
16.00-16.30	Internal deliberation panel
16.30-17:00	Q&A programme management BSc Informatica, MSc Computational Science

Thursday 27 November

08.45-09.15	Welcome and preliminary discussion panel
09.15-10.00	Interview MSc Software Engineering students and alumni
10.00-10.45	Interview MSc Software Engineering teaching staff
10.45-11.15	Internal deliberation panel
11.15-12.00	Interview Examinations Board
12.00-13.00	Lunch
13.00-14.00	Thematic session 1
14.00-15.00	Thematic session 2
15.00-15.30	Final management interview
15.30-16.30	Internal deliberation panel
16.30-17.00	Feedback from the panel

Appendix 4. Materials

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

The panel also studied other materials, which included:

- Reading guide and roadmap
- SWOT Analysis
- Student chapter
- Report previous visitation
- Yearly report Examinations Board
- Yearly report Programme Committee
- TER 23-24
- Curriculum overview
- Minutes Professional Advisory Board
- Alumni survey results
- List of teaching staff and examiners
- List of external teaching staff
- Thesis assessment rubric
- Assessment plan
- Thesis supervisor manual
- Graduation project student manual
- Study guide
- Alumni survey
- Course materials for a select number of courses
- Cooperation agreement UvA-VU Computational Science
- Handbook cooperation UvA-VU joint education