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B Informatica | B Data Science and Artificial Intelligence |
M Computer Science | M Creative Intelligence & Technology
Leiden University

www.academion.nl
info@academion.nl

Project code P2409

Contents

Summary

Standard 1. Intended learning outcomes

The INF bachelor stands out for its rigorous, research-oriented foundation in computer science, effectively preparing students with a balanced blend of theoretical knowledge, practical skills, and transferable competencies. Its strong academic grounding equips graduates for further academic pursuits or professional roles in diverse sectors. The collaboration with the Faculty of Governance and Global Affairs in the I&E specialization adds valuable interdisciplinary breadth, though this track currently faces challenges in the connection to the rest of the INF curriculum and the alignment with core computer science standards. The programme's commitment to continuous improvement and responsiveness to student and industry needs is commendable, with room to sharpen its industry orientation and clarify specialization pathways to better meet evolving expectations.

The DSAI bachelor satisfies with its focused and multidisciplinary approach to the rapidly evolving domains of AI and data science. It successfully blends solid theoretical foundations in programming, statistics, and machine learning with practical application and ethical reflection, preparing students for responsible and effective contributions to academia and industry alike. The inclusion of societal issues such as cybersecurity and privacy, alongside active learning and mentorship, creates a rich educational environment that fosters both technical expertise and transferable skills. It is an adequate response to one of the recommendations from the initial accreditation, which urged the programme to include topics like privacy, ethics and soft skills. The programme's strategy to avoid transient trends and maintain a future-proof curriculum is particularly praiseworthy. While the data science elements could be made more explicitly visible within the curriculum, the programme's responsiveness and alignment with national frameworks (KION) ensure its relevance and robustness in meeting labor market demands.

The CrIT master distinguishes itself through its unique interdisciplinary and creative ethos that integrates computing theory with human-centered and societal perspectives. The programme fosters independent, self-propelling researchers who are adept at using technology creatively to address complex societal challenges. The curriculum's emphasis on experiential, collaborative learning and on the fusion of computer science, cognitive science, arts, and philosophy nurtures students' scientific curiosity and methodological accuracy. The panel welcomes the preparation of graduates for diverse career paths spanning academia, cultural sectors, creative industries, and entrepreneurship. The programme demonstrates a strong commitment to evolving its profile, enhancing synergy with other LIACS programmes, and integrating transferable skills, making it an innovative and inspiring educational offering.

The CS master offers a broad, flexible, and research-driven education that equips students with deep specialist knowledge and strong independent research capabilities across multiple domains of computer science. Its well-structured specializations cater to diverse student interests and career goals, covering both core technical areas and interdisciplinary applications. The programme's alignment with international academic standards and its integration of societal and ethical considerations reflect a mature and comprehensive educational approach. While the extensive range of specializations provides attractive flexibility, the programme may benefit from developing a clearer overarching vision and possibly establishing a common core curriculum to enhance coherence and focus. The programme's proactive responses to evolving technological trends and labor market needs underscore its relevance and quality.

The panel contentedly notes that all programmes exhibit a strong research focus consistent with the visions of the Faculty of Science and the university. The intended learning outcomes are well-aligned with academic

and industry standards. The panel values the interactions with the professional field and is happy to see the ongoing emphasis of programmes on improving the clarity of learning outcomes and integrating transferable and societal skills.

Standard 2. Teaching-learning environment

The panel appreciates that the curriculum of both specializations of the INF bachelor is well-aligned with the intended learning outcomes, offering a thoughtfully structured framework through learning trajectories that balance flexibility and coherence. It is commendable that the programme maintains a strong theoretical foundation while providing meaningful opportunities for practical application. The I&E specialization admirably integrates computer science with business and economics, creating a well-balanced interdisciplinary profile that enriches students' academic and professional readiness. While the I&E curriculum provides solid fundamentals, the panel constructively recommends revisiting this specialization to create a stronger alignment with the overall programme learning outcomes, thereby strengthening its coherence and depth. The programme demonstrates commendable graduation rates that align well with national averages. Conversations with students reveal that the initial study workload can be challenging. The panel encourages the programme to further enhance its communication of study expectations to first-year and prospective students. By doing so, the programme can continue to empower students with a clear understanding of the curriculum demands, fostering their preparedness and supporting even greater study feasibility.

The panel commends the DSAI bachelor for its clearly structured and coherent curriculum, which aligns closely with its intended learning outcomes and vision. The thoughtfully designed learning trajectories expertly balance theoretical foundations with practical application, creating a programme that is challenging but feasible and fostering both academic rigour and real-world readiness. Students particularly value the freedom and flexibility they experience within assignments, which encourages personalized learning and nurtures individual academic interests. The integration of hands-on experiences is a noteworthy strength, effectively developing students' programming and technical skills while cultivating essential professional competencies like client interaction and project management. Student feedback highlights the curriculum design that begins with a strong theoretical base and progressively connects theory to practice, enhancing their appreciation of the relevance and applicability of their knowledge. The interdisciplinary nature of the programme, uniting computing with domains such as psychology and artificial intelligence, is a distinctive asset that enriches the academic environment and broadens students' perspectives. The panel notes that the data science component appears somewhat underrepresented relative to the artificial intelligence component. The panel encourages the programme to enhance the visibility and emphasis of the data science aspects within the curriculum, thereby strengthening this vital pillar of the programme's interdisciplinary character.

The panel appreciates the thoughtfully structured and coherent CrIT curriculum, with its content closely aligned to the intended learning outcomes and the programme's inspiring vision. The programme offers an impressive variety of courses, internships, and exchange opportunities, providing students with rich avenues for academic and professional growth. Notably, the collaboration with the DSAI bachelor and the CS master is actively fostered, enhancing interdisciplinary learning. The programme excels in systematically developing both academic and professional skills through well-chosen didactic methods. Its strong research orientation is commendable, effectively integrating diverse research domains while empowering students to pursue individualized and flexible learning trajectories. The CrIT master shines through its small cohort size, which enables personalized feedback and dedicated support for each student. The collaborative work in diverse, multidisciplinary groups enriches students' perspectives and provides valuable opportunities to experience various roles. This intimate programme structure fosters a vibrant sense of community and strong bonds

among students and staff, celebrating the rich diversity of backgrounds and enhancing collaboration and mutual support. The programme's low dropout rate is a testament to its effective retention strategies, and the occasional extended study duration often reflects students' enthusiastic involvement in engaging projects, highlighting their high motivation.

The panel commends the CS master for its comprehensive and richly detailed curriculum, featuring a wide range of specialized courses. The well-structured and coherent specializations provide students with deep expertise in their chosen fields, reflecting the programme's commitment to academic excellence. The panel suggests exploring the introduction of a common core curriculum. Such a core would establish a foundational knowledge base essential for all students, irrespective of their specialization or elective choices. This would align well with the programme's vision and further strengthen its academic coherence. The panel also acknowledges the programme's solid development of academic and professional skills throughout the curriculum. It welcomes the proactive steps taken to enhance labor market preparation and career orientation, and encourages the programme to continue building on these efforts to support student transitions from study to employment.

The panel values the proactiveness of the CS master in enhancing its feasibility. Noteworthy improvements include the thoughtful revision of specializations and the well-considered decision to discontinue the mandatory introductory research project, which together have streamlined the curriculum. Additionally, targeted measures to support students during their thesis projects demonstrate a strong commitment to study success. The panel positively acknowledges the programme's initiatives to support international students. The panel encourages the programme to explore creative ways to foster a stronger, shared sense of belonging among both Dutch and international students. Also, the panel advises the programme to continue enhancing student support services, especially in facilitating internships.

In summary, the panel appreciates the well-structured and coherent learning trajectories which balance theoretical knowledge with practical applications, and which offer students meaningful flexibility to tailor their individual study paths. The thoughtful designs and effective didactic approaches reflect programmes that are comprehensive and aligned with the intended learning outcomes. The interdisciplinary character, broad course options, internships, and exchange opportunities enrich the educational experience. The panel is content to see that the learning environment of the programmes offers a supportive and inclusive atmosphere and would like to emphasize the important role of the study advisors. Ongoing efforts to address administrative challenges and to strengthen student communities are welcomed by the panel and are expected to optimize student learning and success. The teaching staff exhibits professionalism, capability, and dedication, with ample opportunities for professional growth, and is well-equipped to support students in achieving the intended learning outcomes.

Standard 3. Student assessment

The panel is pleased to observe that the programmes have established a robust and thoughtfully articulated assessment system, which provides transparent insight into students' achievement of learning outcomes. This well-structured approach is supported by a comprehensive teacher's handbook containing clear rules and guidelines, as well as detailed and extensive test matrices, all of which significantly enhance the quality and coherence of the assessment framework. Particularly valued are the procedures for assessing bachelor's and master's theses, where the involvement of multiple examiners strengthens the quality and reliability of the assessment process. The Board of Examiners consistently and professionally fulfills its legal responsibilities, maintaining a clear quality control cycle that includes blind reassessments and the use of standardized rubrics for thesis evaluation. The use of oral examinations as a complementary tool to confirm attainment of learning outcomes is effectively implemented and appreciated by the panel. The programmes

acknowledge the challenge of addressing plagiarism and have responded by increasing the use of oral exams and exploring innovative assessment methods to uphold academic integrity. The panel supports these efforts and suggests further improving expectation management regarding plagiarism, complemented by stringent policies on plagiarism checks for code submissions. Furthermore, the panel advises continuous investment in improving the quality of feedback and in calibration exercises among examiners to ensure consistent assessment standards.

The panel welcomes the proactive stance of the CrIT programme toward the assessment of creative projects, recommending ongoing attention to maintain the validity of this assessment component. The panel recommends careful management of the BoE's workload and responsibilities to safeguard sustained quality and efficiency.

Standard 4. Achieved learning outcomes

The panel compliments the programmes with the high level of the theses. The panel is happy to see that graduates are well prepared for further academic progression and professional practice. The quality of theses and the academic or professional functioning of alumni show that students of all programmes realize the intended learning outcomes.

Score table

The panel assesses the programmes as follows:

Bachelor's programme Informatica	
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

Bachelor's programme Data Science and Artificial Intelligence	
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

Master's 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

Master's programme Creative Intelligence & Technology

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

Prof. dr. S. (Sjouke) Mauw [panel chair]
Date: 1 October 2025

Dr. R. (Rik) Ligthart [panel secretary]

Introduction

Procedure

Assessment

On 16, 17 and 18 June 2025, the bachelor's programme Informatica, the bachelor's programme Data Science and Artificial Intelligence, the master's programme Computer Science and the master's programme Creative Intelligence & Technology of Leiden University were assessed by an independent peer review panel as part of the cluster assessment WO Informatica groep 3. The assessment cluster consisted of 27 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).

Leiden University also requested the panel to consider the faculty-wide specialization Business Studies. This specialization is organized by the computer science department LIACS (Leiden Institute of Advanced Computer Science), and consists of a 60 EC specialization opportunity for students of the 120 EC master's programmes Astronomy (ISAT 60200), Biology (ISAT 66860), Bio-pharmaceutical Sciences (ISAT 60207), Chemistry (ISAT 66857), Life Science and Technology (ISAT 66286), Mathematics (ISAT 66980) and Physics (ISAT 60202). Students combine the specialization with 60 EC education in one of these master's programmes, and receive the corresponding master's degree. Since the specialization Business Studies is not a separate programme, it is not assessed as such. In this report, the panel discusses the quality by standard and makes recommendations.

Quality assurance agency Academion coordinated the assessment upon request of the cluster WO Informatica groep 3. Peter Hildering and Yannick Slagter acted as coordinators in the cluster assessment. Rik Ligthart acted as secretary for the assessment of the programmes of Leiden 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 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 programmes composed a site visit schedule in consultation with the coordinator (see appendix 3). 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 programmes provided the coordinator with a list of graduates over the academic years 2023-2024 and 2024-2025. In consultation with the coordinator, the panel chair selected 15 theses per programme. He took the diversity of final grades and examiners into account, as well as the various specializations (when applicable).

- For the bachelor's programme Informatica, eight theses were selected from the specialization Informatica and four theses from the specialization Informatica & Economie. The panel also considered theses from the discontinued specializations Kunstmatige Intelligentie (one thesis) and Bioinformatica (two theses). This selection reflected the number of graduates in each particular specialization proportionally.
- For the master's programme Computer Science, the panel selected five theses from each of the specializations Artificial Intelligence and Data Science, two theses from the specialization Advanced Computer Science, and one thesis from each of the specializations Bioinformatics, Foundations of Computing, and Computer Science and Science Communication & Society. During the accreditation period, no graduates were available for the Computer Science and Education specialization.
- For the specialization Business Studies, 8 internship reports were selected.

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 self-evaluation reports 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 self-evaluation reports 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. 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 coordinators 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 Leiden University 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 Leiden University.

Panel

The panel assessing the bachelor's programme Informatica, the bachelor's programme Data Science and Artificial Intelligence, the master's programme Computer Science and the master's programme Creative Intelligence & Technology at Leiden University consisted of the following members:

- Prof. dr. S. (Sjouke) Mauw, full professor in Security and Trust of Software Systems at the University of Luxembourg (Luxembourg) [panel chair];
- Prof. dr. S. (Sandjai) Bhulai, professor in Business Analytics at Vrije Universiteit Amsterdam;
- Dr. Ir. C.C.S. (Cynthia) Liem, associate professor at the Multimedia Computing Group of Delft University of Technology;
- Prof. dr. M.H.M (Mark) Winands, professor in Machine Reasoning at Maastricht University;
- F.P. (Floris) Westerman MSc., alumnus (2024) of the master programmes Computer Security at the Vrije Universiteit Amsterdam, Computing Science (track Software Engineering and Distributed Systems) at the University of Groningen, and Logic (track Logic & Computation) 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:	Leiden University
BRIN-number:	21PB
Status of the institution:	Publicly funded institution
Result institutional quality assurance assessment:	Positive
Programme name:	B Informatica
ISAT number:	56978
Orientation of the programme:	wo
Level of the programme:	Bachelor (NLQF 6)
Number of credits:	180 EC
Language of instruction:	Dutch
Professional requirements:	No
Specializations or tracks:	Informatica Informatica & Economie
Location:	Leiden
Mode(s) of study:	Fulltime
Awarded degree:	BSc.
Submission date NVAO:	1 May 2026
Programme name:	B Data Science and Artificial Intelligence
ISAT number:	50300
Orientation of the programme:	wo
Level of the programme:	Bachelor (NLQF 6)
Number of credits:	180 EC
Language of instruction:	English

Professional requirements:	No
Location:	Leiden
Mode(s) of study:	Fulltime
Awarded degree:	BSc.
Submission date NVAO:	1 May 2026

Programme name:	M Computer Science
ISAT number:	60300
Orientation of the programme:	wo
Level of the programme:	Master (NLQF7)
Number of credits:	120 EC
Language of instruction:	English
Professional requirements:	No
Specializations or tracks:	Advanced Computing and Systems Artificial Intelligence Bioinformatics Data Science Foundations of Computing Computer Science and Education Computer Science and Science Communication & Society
Location:	Leiden
Mode(s) of study:	Fulltime
Awarded degree:	MSc.
Submission date NVAO:	1 May 2026

Programme name:	M Creative Intelligence & Technology
ISAT number:	60206
Orientation of the programme:	wo
Level of the programme:	Master (NLQF7)
Number of credits:	120 EC
Language of instruction:	English
Professional requirements:	No
Location:	Leiden
Mode(s) of study:	Fulltime
Awarded degree:	MSc.
Submission date NVAO:	1 May 2026

Description of the assessment

Organization

The programmes are embedded in Leiden University's Faculty of Science, which is organized into eight institutes. LIACS is responsible for education and research in the field of Computer Science and Artificial Intelligence. LIACS offers two bachelor's and two master's programmes and the master's specialization Business Studies. Programme directors, programme managers, education coordinators, study advisors, student coaches, education support staff members, and academic staff are involved in the various education programmes. Each programme is associated with a Programme Committee and a Board of Admissions, while all programmes fall under the LIACS Board of Examiners.

The master's specializations Computer Science and Education (Edu) and Computer Science and Science Communication and Society (SCS) are part of the faculty-wide specializations Education and SCS, respectively. The specialization Edu was considered during the accreditation of the master's programmes Leraar Voorbereidend Hoger Onderwijs in de Bètawetenschappen (ISAT 68533) in 2020, and the specialization SCS during the accreditation of the master's programme Biology (ISAT 66860) in 2021. This report, therefore, only considers the Computer Science-part of these specializations, and not the specialization-specific content.

Recommendations previous panel

The previous accreditation panel provided several suggestions for improvement. Suggestions applicable to the bachelor's programme Informatica and the two master's programmes include, among others, applying the four-eyes principle when creating exams, developing a clear skills learning trajectory, and showing a more proactive attitude from the Board of Examiners with relation to policy and regulations. The bachelor's programme Data Science and Artificial Intelligence was accredited in 2021 and started per academic year 2022-2023. Recommendations from the initial accreditation contain, among others, highlighting the DSAI profile in the learning outcomes and embedding societal and legal aspects more broadly in the curriculum.

The panel finds that these advices have been considered carefully, leading to further improvement of the programmes. 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

Mission and profile: Bachelor Informatica

The bachelor's programme Informatica (B INF) aims to provide students with a solid foundation in computer science, grounded in research-oriented education and aligned with global standards. The programme offers academic education in computer science, emphasizing foundational knowledge and current concepts within the field. It aims to develop the ability of students to independently analyze problems, conduct supervised research, and design software systems while understanding their societal impact. The mission emphasizes the development of theoretical knowledge, practical skills, and transferable competencies necessary for

academic progression or professional practice. The curriculum covers a broad range of computer science topics, including programming, systems, algorithms, data management, artificial intelligence, and theory, supported by a strong mathematical foundation. The programme also integrates transferable skills such as research methods, academic writing, ethics, and societal reflections related to computing. The curriculum is structured to progressively build technical expertise and professional skills.

The programme aims to prepare graduates to meet the evolving demands of the computing field. Graduates predominantly pursue advanced studies in master's programmes in computer science or related fields, often within Leiden University or other institutions. Students are prepared for research-oriented roles and technical positions across academia, industry, government, and non-profit sectors, including roles in software development, data science, artificial intelligence, and systems architecture.

The INF bachelor offers two specializations:

- Informatica: This is the main specialization of the programme and is divided into six learning trajectories including among others research/skills, theory and systems/hardware.
- Informatica & Economics: This specialization is organized in collaboration with the Faculty of Governance and Global Affairs (FGGA) of Leiden University. Courses in (Business) Economics are taught by staff members from this faculty. The specialization combines computer science with business economics. It has less focus on theory and systems/hardware compared to the Informatica specialization, condensing these topics into a core computer science trajectory.

Mission and profile: Bachelor Data Science and Artificial Intelligence
The bachelor's programme *Data Science and Artificial Intelligence* (B DSAI) is a research-oriented programme concentrating on data science and artificial intelligence. It is designed to equip students with a solid foundation in programming, statistics, machine learning, and AI, alongside research skills and ethical considerations. The programme emphasizes practical and theoretical training to prepare students for the rapidly evolving fields of AI and data science, fostering both technical expertise and transferable academic skills. The vision of the programme highlights a multidisciplinary curriculum that integrates societal issues such as cybersecurity, ethics, and privacy. The curriculum integrates hands-on projects, group mentorship, and research skill development, within an international classroom setting.

The DSAI bachelor prepares students for advanced studies or careers where they can responsibly apply AI and data science techniques to real-world challenges. Graduates typically continue their studies in master's programmes related to computer science, artificial intelligence, or cognitive psychology. The programme aims to prepare students for roles in academia, industry, and public sectors.

Mission and profile: Master Creative Intelligence & Technology
The master's programme *Creative Intelligence & Technology* (M CrIT) is committed to educating students who excel at integrating creativity with scientific inquiry in the context of human-centered computing and artificial intelligence. This master's programme takes a multidisciplinary and creative approach to computing and artificial intelligence. It focuses on the creative application of computing theory and methods within human and societal contexts, combining computer science, AI, cognitive science, linguistics, and creative and performative arts. The programme emphasizes research-oriented learning, encouraging students to innovate through scientific inquiry and creative projects. The programme's vision focuses on education that balances theoretical understanding, experimental exploration, and practical application. It emphasizes active, experiential, and collaborative learning, encouraging students to engage critically with societal challenges and ethical considerations. Students engage in project-based learning, research

seminars, exhibitions, and collaborative work. Emphasis is placed on developing scientific curiosity, methodological skills, and the ability to communicate findings to both academic and broader audiences.

The M CrIT programme aims to prepare graduates to contribute innovatively to academia and industry by combining scientific research with creative problem-solving in technology design and application. Graduates are trained for diverse career opportunities including academic research, teaching, positions within the cultural sector (e.g., museums and cultural organizations), creative industries, and entrepreneurship as artists or designers. The programme aims to equip students for roles that require innovative, interdisciplinary thinking and the ability to apply technology creatively in societal contexts.

Mission and profile: Master Computer Science
The master's programme *Computer Science* (M CS) is designed to develop academic professionals equipped with both deep specialist knowledge and the capacity for independent research across multiple computer science domains. The programme prioritizes a research-oriented curriculum that aligns with international standards and emphasizes scientific problem-solving, critical analysis, and responsible professional conduct. It prepares graduates to pursue advanced research or professional careers by fostering autonomy, self-directed learning, and an understanding of societal and ethical implications of computing technologies. The curriculum covers a broad spectrum, including artificial intelligence, data science, software development, systems and security, and theoretical computer science. Students engage in projects, coursework, and a substantial thesis research project. The programme includes specializations tailored to different interests and career paths, each with a clear, distinct structure. Students can choose from two types of specializations, computer science research specializations and interdisciplinary specializations:

1. Computer Science Research Specializations:
    - Advanced Computing and Systems (ACS): Focuses on the technology of computer systems, including high-performance computing, cloud computing, distributed systems, and embedded systems.
    - Artificial Intelligence (AI): Covers topics such as machine learning, evolutionary computation, and optimization, with the option to specialize in Algorithmic AI or Human-Centered AI variants.
    - Bioinformatics (Bio): Deals with data analysis and modelling of biological processes, including computational biology methods, image analysis, and mathematical modelling. This specialization will be discontinued from 2026-2027.
    - Data Science (DS): Focuses on foundational and algorithmic aspects of data mining, information retrieval, machine learning, and statistical data analysis, with electives from statistics to emphasize interdisciplinarity.
    - Foundations of Computing (FoC): Emphasizes core computing concepts and their applications in AI, quantum computing, parallel computing, and software verification and testing.
2. Interdisciplinary Specializations:
    - Computer Science and Education (Edu): Prepares students for a career as a computer science teacher in Dutch upper secondary education, requiring proficiency in Dutch.
    - Computer Science and Science Communication & Society (SCS): Prepares students for careers in science communication or as scientists with a communication focus.

Graduates are prepared for PhD studies, research positions, and advanced professional roles in industry and the public sector. They are trained for work in academia, private companies, government agencies, and non-

profit organizations. Their roles often involve advanced software engineering, AI and data science development, systems security, and teaching.

The panel studied the mission and profile of all programmes and discussed these topics with various programme stakeholders during the site visit. In general, the panel finds that all programmes share a strong research orientation that aligns with the vision of the Faculty of Science and the university. The programmes have a clear mission and learning objectives that align with the requirements of the professional field and the academic discipline. To the satisfaction of the panel, each programme is actively evolving to maintain alignment with academic standards and societal needs. The programmes regularly revisit and update their intended learning outcomes and integrate societal and ethical aspects into the curricula through dedicated courses and modules to ensure this alignment.

The panel sees that the bachelor's programmes provide solid foundational education in computer science and AI, respectively. The split in learning trajectories for the INF bachelor is transparent. The DSAI bachelor responds to the growing interest from academia and industry by providing a programme that balances theoretical foundations with practical application. It does not want to focus on all kinds of hypes, which is commendable. The CrIT master is considered by the panel to be a unique programme due to its interdisciplinary and creative approach. Its mission and profile are commendable for their strong emphasis on fostering independent, self-propelling creative researchers who are equipped to interpret, appropriate, and instigate technological changes in a rapidly evolving world. The CS master offers a broad and flexible research-driven education with multiple specializations. Its focus on integrating learning and research, supporting individual learning pathways, and attention to technological developments makes the programme highly relevant.

With regard to the INF bachelor, the panel recognizes that the programme aims to ensure alignment with both academia and industry. At the same time, students and alumni mentioned to the panel that they feel that the focus of the programme is mainly on research and theory, and that there is a rather limited attention for the industry and public sector. From the discussion with the lecturers of the programme, the panel understands that the programme arranges projects from industry, e.g., projects where students implement software and can choose the business or the programming side of it. The panel advises the programme to reflect on its aim of delivering industry-oriented bachelor graduates, and to sharpen its vision on this topic to better define what the programme is educating for and to better meet students' expectations.

The panel found the positioning of the Informatica specialization Informatica & Economie (I&E) to be ambiguous, currently leaning more towards the DSAI bachelor rather than fitting neatly within its own distinct track within Computer Science. The track is also less aligned with the ACM standards due to differences in programming language focus and content depth in comparison to the Informatica specialization. The panel advises the programme to reassess the positioning of I&E, potentially integrating it more closely with the DSAI bachelor or more clearly defining its status as a computer science programme, while still keeping its unique character to justify it as a separate specialization within computer science.

With regard to the DSAI bachelor, the panel finds that the programme emphasizes computer science and artificial intelligence elements over data science topics. In the discussion with the lecturers of the programme, it becomes clear that the programme integrates data science elements primarily through courses such as Machine Learning and other AI-related topics, but that it does not have a fully explicit or clearly delineated learning trajectory solely dedicated to data science methods like data collection and data cleaning. Given the name of the programme, the panel recommends to make the data science elements more visible and prominent.

The panel found that the specializations combined with a large variety of elective courses in the CS master offer students an attractive freedom and flexibility in composing an individual study path. At the same time, the panel found it difficult to discern a clear focus of the programme due to the highly individual character of each curriculum. It suggests the programme to develop a clear vision on the overall goal of the programme, and reflect on whether the current large number of specialization opportunities is the most effective means to achieve this goal. The panel feels that it might be advisable to create a common core between the specializations to establish this overall goal of the programme (see standard 2).

Intended learning outcomes
The goals of each programme have been translated into a set of intended learning outcomes (ILOs) for each programme (see appendix 1). The INF bachelor defines its ILOs with a focus on foundational computer science knowledge, research-oriented skills, and professional competencies. They are designed to meet the expectations of the professional field, the discipline of computer science, and international standards, including alignment with the 2023 ACM Model Curriculum. The ACM (Association for Computing Machinery) Model Curriculum refers to a series of curriculum recommendations for various computing disciplines. The two specializations have specific learning outcomes tailored to their focus areas.

The learning outcomes of the DSAI bachelor are defined to reflect the academic level and the multidisciplinary nature of the programme, emphasizing research competence and societal awareness. They match the national KION standard to ensure compliance with academic frameworks and relevance to the professional field. KION (Kunstmatige Intelligentie-Opleidingen Nederland) is a collaboration between the Artificial Intelligence study programmes of participating Dutch universities. It defines a collective framework for AI education at the bachelor's and master's level, among others, to ensure that KION Artificial Intelligence bachelor's degrees give access to KION master's programmes in the Netherlands.

The master's programmes adhere to the QAA (Quality Assessment Association) standards for ICT. These standards focus on ensuring the effective use of information and communication technology to support learning, teaching, and assessment. It outlines expectations for institutions to integrate ICT into their educational practices, ensuring it enhances the student experience and academic quality. The CrIT master applies learning outcomes that mirror its research-driven and interdisciplinary profile, integrating computer science, artificial intelligence, cognitive science, and creative arts. The learning outcomes emphasize both theoretical depth and practical application, encouraging independent research skills and societal responsibility. The CS master offers learning outcomes that encompass specialist knowledge areas, scientific problem-solving, and independent research capabilities. Their learning outcomes are split into two categories: general programme learning outcomes and specialization-specific learning outcomes for each of the seven specializations.

Based on the documentation and the conversations during the site visit, the panel establishes that the intended learning outcomes of all four programmes correspond with the academic level and orientation of the programmes. All ILOs are clearly defined and aligned with the Dublin descriptors and the NLQF framework on level 6 (bachelor) and 7 (master). They are consistent with academic standards at the bachelor's and master's levels and aligned with domain-specific national or international frameworks. The panel welcomes the ongoing programmes' emphasis on improving the explicitness and clarity of ILOs, their alignment with curricular content, and the integration of transferable and societal skills. Specifically, for the DSAI bachelor, the panel finds that its theoretical foundations are visible in the intended learning outcomes, with which the programme successfully follows up on one of the recommendations from the initial accreditation.

Role of the professional field

The programmes involve the professional field in various ways. Engagement is facilitated through guest lectures, alumni talks, and involvement of the student association in organizing industry-related events and lectures. These activities help in keeping the curricula and learning outcomes up-to-date with current industry standards and expectations. A recent appointment has been made for an internship and alumni coordinator to structure contacts with the professional field.

From the documentation and discussions during the site visit, it is clear to the panel that the programmes have strong connections to the professional field. Currently, these relationships are primarily based on personal networks of the LIACS staff. These personal, informal networks are of great value to the programmes and to students. Yet, the panel believes that a more structured, strategic network would be an important addition. Such a network could help the programmes in dealing with all kinds of strategic decisions, such as the positioning of programmes. Therefore, the panel recommends the establishment of a strategic advisory board, populated by representatives from the professional field, to formalize and enhance the interactions with the field.

Considerations

The INF bachelor stands out for its rigorous, research-oriented foundation in computer science, effectively preparing students with a balanced blend of theoretical knowledge, practical skills, and transferable competencies. Its strong academic grounding equips graduates for further academic pursuits or professional roles in diverse sectors. The collaboration with the Faculty of Governance and Global Affairs in the I&E specialization adds valuable interdisciplinary breadth, though this track currently faces challenges in the connection to the rest of the INF curriculum and the alignment with core computer science standards. The programme's commitment to continuous improvement and responsiveness to student and industry needs is commendable, with room to sharpen its industry orientation and clarify specialization pathways to better meet evolving expectations.

The DSAI bachelor satisfies with its focused and multidisciplinary approach to the rapidly evolving domains of AI and data science. It successfully blends solid theoretical foundations in programming, statistics, and machine learning with practical application and ethical reflection, preparing students for responsible and effective contributions to academia and industry alike. The inclusion of societal issues such as cybersecurity and privacy, alongside active learning and mentorship, creates a rich educational environment that fosters both technical expertise and transferable skills. It is an adequate response to one of the recommendations from the initial accreditation, which urged the programme to include topics like privacy, ethics and soft skills. The programme's strategy to avoid transient trends and maintain a future-proof curriculum is particularly praiseworthy. While the data science elements could be made more explicitly visible within the curriculum, the programme's responsiveness and alignment with national frameworks (KION) ensure its relevance and robustness in meeting labor market demands.

The CrIT master distinguishes itself through its unique interdisciplinary and creative ethos that integrates computing theory with human-centered and societal perspectives. The programme fosters independent, self-propelling researchers who are adept at using technology creatively to address complex societal challenges. The curriculum's emphasis on experiential, collaborative learning and on the fusion of computer science, cognitive science, arts, and philosophy nurtures students' scientific curiosity and methodological accuracy. The panel welcomes the preparation of graduates for diverse career paths spanning academia, cultural sectors, creative industries, and entrepreneurship. The programme demonstrates a strong commitment to evolving its profile, enhancing synergy with other LIACS programmes, and integrating transferable skills, making it an innovative and inspiring educational offering.

The CS master offers a broad, flexible, and research-driven education that equips students with deep specialist knowledge and strong independent research capabilities across multiple domains of computer science. Its well-structured specializations cater to diverse student interests and career goals, covering both core technical areas and interdisciplinary applications. The programme's alignment with international academic standards and its integration of societal and ethical considerations reflect a mature and comprehensive educational approach. While the extensive range of specializations provides attractive flexibility, the programme may benefit from developing a clearer overarching vision and possibly establishing a common core curriculum to enhance coherence and focus. The programme's proactive responses to evolving technological trends and labor market needs underscore its relevance and quality.

In conclusion, the panel contentedly notes that all programmes exhibit a strong research focus consistent with the visions of the Faculty of Science and the university. The intended learning outcomes are well-aligned with academic and industry standards. The panel values the interactions with the professional field and is happy to see the ongoing emphasis of programmes on improving the clarity of learning outcomes and integrating transferable and societal skills.

Conclusion

The panel concludes that the programmes 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 B INF

The INF bachelor is a 180 EC programme. The curriculum (see appendix 2, also for the curricula of the other three programmes and the Business Studies specialization) is organized into several learning trajectories that span the three years of study. These trajectories include among others Research/Skills (on academic writing, presentation, collaboration, ethics and social aspects), Mathematics, Data/AI, Programming/Software, Theory, and Electives/Minors. The electives allow students to broaden their knowledge through minors (including options at partner universities) or deepen their expertise with advanced courses closely related to LIACS research areas, such as Quantum Computing, Natural Computing, and Natural Language Processing. The Informatica & Economie specialization allocates fewer ECs to core theory and systems courses and instead includes 36 EC in (business) economics taught by the Faculty of Law and the Faculty of Governance and Global Affairs. The I&E specialization contains about 60% computer science and 40% economics content, preparing students for interdisciplinary careers bridging both domains. In the I&E specialization, students learn Python, whereas in the Informatica specialization, students learn C++ with a deeper focus on data structures and algorithms.

The INF bachelor concludes with a 15 EC thesis project. Students conduct an individual research project supervised by an academic staff member. The thesis work is primarily internal research linked to LIACS research clusters. The matching of students to supervisors is no longer done centrally but through representatives of various research clusters at LIACS, ensuring a computer science staff member supervises the project and a fair distribution of students across staff. In parallel, students participate in a bachelor class that organizes research activities such as poster and midterm presentations to help students stay on track

and connect with peers. Students can take additional electives in the fall semester of year three to deepen their knowledge in the area of their research topic.

Based on a review of the documentation and the conversations during the site visit, the panel finds that the curriculum of both specializations of the INF bachelor fits the intended learning outcomes of the programme. The learning trajectories provide a well-structured framework, allowing students the flexibility to tailor their individual study programmes. From the discussion with the management team, the panel learns that the focus of the programme is more on theory and less on industry. At the same time, there is room for the practical application of theory, for instance, in the previously mentioned software project. Also, the I&E specialization dives deeper into the industry side, as do certain minors. Based on these findings, the panel asserts that students from both specializations can sufficiently develop academic as well as practical skills. The panel believes the I&E curriculum provides sufficient fundamentals in programming and core computer science principles, yet it is advised to reconsider and possibly revise the I&E curriculum to ensure a stronger alignment with the programme's intended learning outcomes.

From the discussion with the students, the panel understands that students follow several classes together with students from the DSAI bachelor. As a result, sometimes students experience that the level of depth of computer science topics is limited. The panel understands that dealing with a variation in student backgrounds is difficult, but nevertheless encourages the programme to explore opportunities to cater for varying student needs. It satisfies the panel to learn that efforts are underway to improve the programming learning trajectory, including separating courses to make the curriculum more coherent and manageable for students with diverse prior knowledge.

Curriculum B DSAI
The DSAI bachelor offers a three-year, 180 EC curriculum that is structured to ensure a broad and deep understanding of core computer science and AI topics, with a clear focus on research-oriented education. Similar to the INF bachelor, the programme is organized into learning trajectories. These trajectories span the first two years and the mandatory part of the third year, and each consists of a number of subsequent courses. The first year of the programme concentrates on establishing fundamental computer science skills and theory, reflecting the view that a competent DSAI professional must primarily be a skilled computer scientist. Key first-year courses include Introduction to Programming, Essentials of Computer Systems, Foundations of Computer Science, and mathematics courses such as Calculus, Linear Algebra, and Probability Theory. Additionally, courses like Orientation AI and AI & Ethics introduce students to societal issues and soft skills early on. The second year builds on this foundation with courses covering among others Software Development, Languages and Computation, Symbolic AI, Human-Agent Interaction, and Statistics. This phase integrates interdisciplinary topics and strengthens both theoretical knowledge and practical skills. In the third year, students have opportunities for specialization and broadening through electives, minors, or study abroad options. The curriculum culminates in a 15 EC thesis project, similar to the INF bachelor. The thesis project involves independent research supervised by academic staff, alongside participation in a bachelor class with peer presentations and progress tracking.

The programme aims for practical application of theory and knowledge in several ways. The Database course is very practically oriented, featuring guest lectures and a practical assignment where students create a database. Students engage in projects that involve clients from industry, civic society, and within the university itself. These projects provide real-life experience in software development and client interaction. Practical programming skills are further developed through live coding sessions, which are integrated into courses to facilitate hands-on learning and immediate application of programming concepts. Also, students

have the opportunity to work with physical robots, allowing them to apply theoretical concepts in tangible, practical projects.

From the discussion with the students, the panel gathers that students have a positive view of their programme, appreciating the balance between theoretical and practical knowledge. They value the solid technical background they gain, including programming skills, which are taught in a broader context with ample practical experience. The programme starts with a strong theoretical foundation and later connects this knowledge to practical applications, allowing students to see how theory informs practice. Students also appreciate the freedom they have in assignments and the ability to choose electives in their third year, enabling them to pursue their individual interests and preferences. The curriculum is recognized for its wide range between theory-oriented courses and practical assignments, supporting a comprehensive learning experience. The interdisciplinary nature of the programme is highlighted as a strength, combining fields such as psychology and artificial intelligence, which enriches the learning experience.

Based on the documentation and discussions during the site visit, the panel finds that the learning trajectories of the DSAI bachelor provide a clearly structured curriculum. The coherence, content, and structure of the curriculum are sound and correspond closely with the intended learning outcomes and the programme's vision. There is a strong integration of theory and practice, and students appreciate the freedom they have within assignments. The curriculum clearly demonstrates an interdisciplinary character. The programme successfully integrates hands-on learning opportunities, such as the practically oriented Database course with guest lectures and tangible assignments, live coding sessions embedded throughout the curriculum, and projects involving real clients from industry and society. This approach not only solidifies students' programming and technical skills but also prepares them for real-world professional environments by fostering client interaction and project management experience. The inclusion of physical robotics projects is a nice example of applying theoretical concepts in a tangible manner, enhancing student engagement and understanding. The panel also notes students' positive feedback regarding the curriculum's design, which starts with a strong theoretical base and gradually connects theory to practice, allowing students to appreciate the relevance and application of their knowledge. The freedom offered to students to select electives in the later years is commendable, supporting personalized learning paths and fostering individual academic interests. Furthermore, the interdisciplinary character of the programme, combining computing with disciplines such as psychology and artificial intelligence, is a distinctive strength that enriches the academic environment and broadens students' perspectives

The panel notes that the data science component is underrepresented in the curriculum compared to the AI component (see also standard 1). Students indicate that topics like data management, data analysis and data visualization are covered but not in depth. The panel believes the curriculum could be strengthened by adding these topics and therefore suggests enhancing the visibility of the data science component in the curriculum.

Curriculum M CrIT

The CrIT master is a 120 EC, interdisciplinary research-oriented programme focusing on the creative application of computing theory and methods. There is a strong focus on mastering new technologies and reflecting on their implementation rather than just the technologies themselves. The first year is fully dedicated to mandatory core courses totaling 60 EC. These courses are designed to cover both theoretical knowledge and practical skills, including topics such as Creative Programming, Human-Computer Interaction & Information Visualization, Research Fundamentals, Playful & Creative Science, and Exhibition: Science to Experience. The curriculum also includes a study trip to the Ars Electronica Festival to inspire and build community among students. In year two, students select two or three accent courses (9 to 18 EC) from

options including AI in Society, Computational Creativity, Research Seminar: Artificial Intelligence, Scientific Narration & Visualization, and Video Games for Research. Skills development is integrated throughout the curriculum, including academic writing, research methods, and transferable skills like collaboration and presentation. Ethical and societal considerations are also addressed in several courses.

Elective courses (10 to 19 EC) allow students to tailor their education to their interests, including courses from other programmes. Students may occasionally undertake an internship as an elective. A key requirement is that the internship project should be the student's own project, not the organization's project. Students can also apply for permission to participate in an exchange, typically in the third semester. If approved, study results obtained during the exchange replace a combination of accent courses and electives worth 28 EC.

There are shared courses introduced between the CrIT master and the CS master, such as AI in Society, Artificial Creatures, and Computational Creativity. Also, there is an ongoing exploration of the possibility of a system of collaboration between CrIT and DSAI students to strengthen ties and possibly enable joint activities or courses.

The CrIT master concludes with a graduation project of 30 EC. Students choose an individual topic or theme freely and submit a proposal and a more detailed project description for approval. They conduct individual research on a specialist topic aligned with the programme and their own accumulated knowledge and skills, supported by a Graduation Lab with biweekly meetings for information on procedures, methods, research skills, and project planning. Students start the Graduation Lab one semester before their project to develop and reflect on their research plans. During the graduation project, the student is supervised by two advisors: one LIACS staff member and one internal or external expert with relevant expertise; both must have a PhD or approved educational skills.

From the discussion with the students, it becomes clear to the panel that students value the unique combination of applied technologies with a creative approach. The programme's strong research focus allows students to engage with cutting-edge topics, participate in conferences, and work on fun, innovative projects. Particularly in the second year, students appreciate the opportunity to interact with diverse fields such as sound design through electives, which enriches their learning experience. Students experience that the freedom to choose their own academic path fosters independence and personal growth.

Based on the documentation and discussions during the site visit, the panel finds that the curriculum of the CrIT master is well-structured, coherent, and that its content aligns effectively with the intended learning outcomes and the programme's vision. The curriculum offers a wide range of options regarding courses, internships, and exchange opportunities. There is a clear effort to establish connections with the DSAI bachelor and the CS master. The study trip to the Ars Electronica Festival was highlighted by students and teaching staff as a positive aspect, contributing not only to the educational experience but also enhancing a sense of community. Both academic and professional skills are systematically developed. The programme demonstrates a strong research orientation, successfully integrating different research areas while providing students with the freedom to tailor their own learning paths.

Curriculum M CS
The M CS curriculum offers a high degree of flexibility, allowing students to compose an individual study path tailored to their interests and background. In the academic year 2024-2025, the programme includes 53 courses spanning a wide range of specialist areas tied closely to the research expertise of the teaching staff. This enables students to immerse themselves in both foundational and state-of-the-art topics within

computer science. The curriculum is structured around two main types of specializations: computer science research specializations and interdisciplinary specializations (see standard 1). Each research specialization requires students to complete six mandatory courses (typically 6 EC each) in the first year, providing a solid foundation in the domain. The second year is devoted primarily to a thesis project (42 EC) and electives, allowing further specialization and depth. Students typically complete 30 EC of electives alongside the thesis, enabling them to enrich their expertise or broaden their knowledge. The interdisciplinary, faculty-wide specializations combine computer science with other disciplines such as Education or Science Communication and Society (SCS). The computer science component is a compressed version of the two-year research specialization, consisting of 30 EC of electives and a 30 EC thesis project in the first year, followed by a 60 EC interdisciplinary component in the second year. This structure allows students to build disciplinary knowledge and then integrate it with another domain.

During the thesis project, students conduct individual research on a specialist topic in computer science, supervised by two PhD holders of whom at least one is LIACS scientific staff. The thesis can be performed internally within a research group at a university (e.g., LIACS) or partially as an internship at a company or organization, provided the research question is scientifically valid and supervised by LIACS staff. Students are supported by a biweekly master class focusing on academic skills, career orientation, and progress monitoring.

From the discussion with the students, it becomes clear to the panel that the students exhibit a positive attitude towards the CS programme, appreciating several key aspects that contribute to their satisfaction and academic growth. Firstly, students value the research-oriented and technical nature of the programme. They recognize that the curriculum is deeply rooted in theory and research skills, with many courses involving projects that encourage problem-solving in open-ended situations where solutions are not predetermined. This stimulates critical thinking and independent inquiry, which students find intellectually rewarding. Moreover, the programme offers flexibility by allowing students to pick courses that align with their interests, which enhances their engagement and motivation. The CS master is also seen as a natural and effective continuation from the bachelor's degree, providing a coherent academic progression. Students appreciate the cutting-edge content of the programme, as it enables them to learn many new and advanced topics, keeping them at the forefront of computer science developments.

Based on the documentation and discussions during the site visit, the panel finds that the CS master presents a comprehensive curriculum with a large number of specialized courses. The specializations are well-structured, coherent, and content-rich, providing students with solid expertise in their chosen areas. As discussed under standard 1, the panel feels that the programme could benefit from a common core for all specializations. This would allow the programme to establish a foundation that it deems essential for all students, regardless of their choice of specialization and electives. The panel advises the management of the programme to determine what would constitute such a foundation, based on its vision for the programme and to design a core that reflects this.

While academic and professional skills are adequately developed throughout the programme, students indicate that the preparation for the labor market and career orientation could be improved to better support their transition to employment. This seems to be an issue primarily for international students. The programme has undertaken actions to improve this, for instance by adding more guest lectures, sharing career preparation events and involving the study association, which organizes industry lectures and job markets. Students appreciate the efforts taken by the programme, saying, among others, that the annual job market is a great way to get in touch with the work field and work requirements. The panel welcomes the actions taken by the programme and suggests to continue on this path.

The panel concludes that the curricula of all four programmes are well-structured and enable students to achieve the intended learning outcomes. By explicitly defining and communicating clear learning trajectories, the programmes have adequately responded to one of the recommendations from the previous panel.

Admission and language of instruction
To be admitted to the INF bachelor, prospective students need a diploma equivalent to the Dutch pre-university diploma (VWO). For the DSAI bachelor, students need a Dutch VWO diploma with Mathematics B, or an equivalent international diploma demonstrating a comparable level of mathematics. The CrIT master is open to students from a wide range of BSc and BA backgrounds in exact and applied sciences, humanities, and social sciences. Candidates must have demonstrable interest in science and scientific research, affinity with technology, creativity, critical thinking, and basic programming skills. Admission procedures include interviews to align student motivation with programme objectives. For the CS master it is required to have a bachelor's degree in Computer Science or Artificial Intelligence from a research university, or completion of at least 90 EC of bachelor-level computer science courses. Students with a bachelor's degree from a university of applied sciences (HBO) usually must complete a pre-master programme due to deficiencies in calculus, linear algebra and academic skills.

The INF bachelor uses Dutch as the language of instruction, although a number of courses are taught in English. Teaching courses in English helps students better express themselves in English, which is useful for subsequent MSc programmes (all of which are in English) or when working in internationally oriented IT companies in the Netherlands or elsewhere. The other programmes use English as the language of instruction, and also have an English language name. The primary justification across these programmes for using English is the international orientation of the academic fields, the presence of international staff and students, and the need to prepare students for global academic and professional environments. The programmes ensure the level of English of teachers by requiring all teaching staff members to obtain the University Teaching Qualification (Basis Kwalificatie Onderwijs, BKO), which includes an integral part called the Basis Kwalificatie Taalvaardigheid Engels (BKE).

The panel finds that the programmes have appropriate admission requirements. Admission procedures are clear and include provisions for bridging programmes and pre-master courses to address knowledge gaps and prepare students adequately for the curriculum. The panel approves of the choice of the English language for the programmes' education and name, and confirms the programmes' rationale that this corresponds to the nature of computer science, AI and creative technology as internationally oriented fields. The English proficiency requirements for teaching staff satisfy the panel.

Learning environment
Both the INF bachelor and the DSAI bachelor feature a teaching format that combines weekly lectures (or one lecture every two weeks) with working groups organized within semester or block structures. These working groups emphasize the integration of theory and practice, offering smaller cohorts of about 30 students opportunities to ask questions and receive guidance, often involving practical exercises using computers or lab equipment. Advanced and later-year courses in both programmes sometimes adopt a seminar-style format, focusing on student presentations, discussions, and group assignments such as software projects or scientific papers. Both programmes are delivered fully on campus, fostering direct interaction between staff and students.

The CrIT master employs a range of instructional methods beyond traditional lectures, including laboratory exercises, thematic research seminars, and collaborative group projects. Students engage actively in small groups, typically of two to three students, fostering teamwork, presentation, and communication skills. They undertake projects that involve investigating scientific publications, formulating research questions, and creating tangible outputs such as installations or games, often culminating in public presentations or exhibitions. The intimate class sizes encourage interactive lectures and active student participation.

The learning environment of the CS master primarily consists of semester-long courses that blend theoretical lectures with practical components such as research projects and presentations. The programme offers both introductory and advanced seminar-style courses, accommodating diverse learning preferences. Class sizes vary, with working groups facilitating smaller, interactive sessions where students can deepen understanding and develop research skills. The curriculum design allows students to tailor their studies flexibly while ensuring coverage of core competencies. Teaching is fully on-site.

The bachelor's programmes offer specific extracurricular courses and competitions focusing on cybersecurity and robotics challenges, while the master's programmes offer mentoring, study trips, and industry-related events to supplement formal education.

All four programmes offer structured mentoring and accessible study advice to enhance student development and progress. Feasibility is addressed among others through carefully designed curricula and transparent communication of learning trajectories, enabling students to plan effectively. Students have access to study advisors, student coaches, and mentors. The study advisors play an important role in supporting students, especially given the increased student numbers and diversity (including neurodiversity and many international students). They handle a wide range of student queries, from academic planning and progress to more administrative issues like tuition payments and immigration. They also help students with mental health and specific needs (e.g., dyslexia), often referring students to specialized services such as psychologists or deans. Student coaches focus on personal and mental well-being and provide tailored support, often including group sessions for specific needs. Mentors are peers (higher-year students) supporting new students with practical and social integration into the programme.

The use of digital learning environments such as Brightspace is standard across programmes, providing students with access to course materials and information. Facilities, including modern computer labs and collaborative spaces, support the programmes' educational activities. Diversity and inclusion are actively promoted, with programmes aiming to create an inclusive and welcoming atmosphere for students and staff. Initiatives include mandatory workshops on cross-cultural communication and codes of conduct to foster social and psychological safety. The programmes provide tailored support to students with diverse needs, promoting equitable access to learning opportunities.

Based on the documentation and site visit discussions, the panel concludes that the learning environments of the four programmes demonstrate a strong dedication to research-oriented, student-centered education. There is a positive atmosphere marked by strong interaction between lecturers and students, as well as among peers, that facilitates active, experiential, and collaborative learning. Students from all programmes, including the larger bachelor's programmes, praise the experienced small-scale character of their programmes. The recent relocation to a new building has positively impacted facilities, offering improved study spaces and modern computer labs for both students and staff. Teaching methods are diverse, including lectures, interactive sessions, group assignments, and project-based learning, which collectively support the development of academic and professional skills. The increased attention for innovative

teaching methods is an appropriate response to one of the recommendations of the previous panel. The availability of extracurricular activities further enriches the educational experience.

The panel sees that the programmes offer strong guidance frameworks, including personalized supervision, accessible study counseling and supportive study advisors, helping students navigate their academic journeys. Information provision in the programmes is up to standard, with clear communication of curricular expectations and progression pathways, with attention to workload management and curriculum feasibility to prevent undue study load. The panel sees commitment to diversity and inclusion reflected in efforts to accommodate varied student needs and foster an inclusive environment. Accessibility for students with functional impairments is adequately addressed. Diversity and inclusion are actively promoted across the programmes. Efforts are made to accommodate diverse student backgrounds, including support for students transitioning from different educational systems.

The panel finds that the integration of study advisors in the quality assurance process could be improved. They are not yet fully embedded in the quality management system. Despite frequent meetings and attempts to provide feedback, the study advisors mentioned to the panel that it is not always clear how much influence their input has on outcomes. To increase their role in the quality assurance cycle, the panel recommends to better embed study advisors structurally within the quality assurance framework. This could involve more direct participation in curriculum evaluation meetings, closer collaboration with teaching staff and programme management to address study progress and workload issues, and a more systematic use of data gathered by study advisors on student progress and challenges to inform curriculum improvements. Enhancing their role in feedback loops would help ensure that student support needs are addressed more effectively and proactively.

From the discussions, it becomes clear that students and teachers from all programmes are very unhappy with the enrollment process for exams and courses. It is relatively easy in the software used for this purpose to make a mistake, and students who are not registered properly for their exams have their grades invalidated, without the opportunity for teaching staff members to intervene. This is a source of stress for students as well as study advisors and teaching staff, resulting in a lot of extra work for all involved. These suboptimal course and exam registration procedures hinder the learning experience. Even though this is a central university policy issue that is beyond the scope of this programme review, the panel noted that both staff and students felt very strongly about this issue in several interviews during the site visit. It therefore strongly advises the university to remedy this issue to improve efficiency and alleviate workload and stress for both staff and students.

The INF bachelor shows Binding Study Advice (BSA) percentages above 70% and graduation rates in line with national averages. In discussion with students from the INF bachelor, it was mentioned that study workload can be quite high in the beginning. There is a strong emphasis on programming and mathematics, which is more challenging than students initially anticipated. The panel suggests that the programme explores ways to communicate expectations more clearly, particularly regarding study workload, to first-year students and prospective students, in order to better prepare them for the demands of the programme and to increase feasibility.

The DSAI bachelor has a good BSA percentage (85% for the academic year 2023-2024), indicating satisfactory early progress of students. Official graduation statistics are not yet available as the programme is relatively new. There are semester preparation meetings to align course deadlines and avoid overload, especially in heavier semesters such as semester 4. In the discussion with the students, they expressed that the study load is manageable.

Regarding the CrIT master, the panel finds that the programme benefits from its small cohort size, facilitating personalized feedback and support. Working in mixed, multidisciplinary groups broadens students' perspectives and offers ample opportunities to explore various roles. Additionally, the programme's small size and structure promote a strong sense of community and close connections among students and staff, effectively embracing the diverse backgrounds of its students and enhancing collaboration and support. The dropout rate is low, indicating successful retention strategies. While students often exceed the nominal study duration, this is frequently due to voluntary engagement in enjoyable projects, reflecting high student motivation. The panel identifies a limitation in available space for practical student projects, particularly in terms of rooms where installations can remain set up. The panel advises exploring possible solutions to address this constraint.

The CS master has taken several actions to improve its feasibility, including a revision of the specializations, the abandonment of a mandatory introductory research project, and measures to improve thesis feasibility. The panel compliments the CS master with improving its feasibility. The proportion of students graduating within three years has increased to approximately 63%, compared to previously being around 50%. Additionally, the average duration of study is now shorter than the average for all master's programmes within the Faculty of Science.

From the discussions during the site visit, the panel notices the absence of a genuine community feeling among CS master students. There is a programme for international students held two weeks before the start of the academic year, which provides a soft landing and helps them acclimate to the new environment. This is a positive initiative aimed at easing the transition for new international students. Despite this programme, new students find it difficult to settle in because student groups tend to have already formed by the time they start their courses. This can hinder social integration and the establishment of new connections within the cohort. The panel recommends exploring options to build a stronger student community in which Dutch and international students develop a shared sense of belonging, and both feel supported while finding their way in the job market.

In the CS master, international students in particular face challenges in finding internships or employment opportunities, while non-EU students often cannot extend their study duration due to financial constraints. The CS programme acknowledges as one notable problem the non-fluency in Dutch among international students, which poses difficulties because many IT jobs, especially those within government or consulting companies serving government clients, require proficiency in Dutch. However, there are internship possibilities in The Hague, which is nearby and hosts many relevant (international) organizations. The panel advises to search for ways to further improve student support, especially in finding internships.

Teaching staff

The teaching staff associated with the programmes predominantly consists of assistant professors, associate professors, full professors, and dedicated lecturers, many of whom are active researchers within LIACS. All teaching staff members are required to obtain the University Teaching Qualification (Basiskwalificatie Onderwijs, BKO), which underscores didactic competence and commitment to quality education. Most academic staff, including teaching PhDs, have obtained or are actively pursuing this qualification. Additionally, the Basis Kwalificatie Taalvaardigheid Engels (BKE) is integrated into the BKO programme to ensure that teaching staff maintain a high level of English proficiency (level C1 or higher). New teaching staff members receive regular mentorship and support from more senior staff in order to facilitate their integration and ensure consistency in teaching quality. Moreover, all staff members participate in an annual educational cycle, which includes reflection on teaching activities and engagement with continuous

professional development. The LIACS teaching community fosters an open and collegial atmosphere where peer feedback on teaching is encouraged, contributing to ongoing improvement.

The standard teaching load for full-time academic staff is typically one 6 EC course per semester, usually comprising one bachelor's and one master's course in each academic year. Lecturers with teaching-only positions generally handle two 6 EC courses per semester. Teaching responsibilities are distributed equally, with administrative tools being introduced to monitor workload fairness. While LIACS has experienced some staff turnover in recent years, resulting in changes to course instructors, steps have been taken to stabilize the teaching teams. The programmes state that staff members appreciate the autonomy granted in course content and design, which fosters a strong sense of ownership and responsibility for their courses. This independence, coupled with their active research roles, helps maintain a high academic standard and relevance of the curriculum. The involvement of senior staff in teaching also facilitates the transfer of expertise and pedagogical skills within the team.

Based on the documentation and discussions during the site visit, the panel finds that the teaching staff is highly qualified and possesses strong subject-matter expertise, which contributes positively to the quality of education. They exhibit a high level of dedication and professionalism, contributing substantially to the quality and coherence of the education offered across all programmes. The close connection between research and teaching ensures that the curriculum remains up-to-date and closely aligned with current scientific and technological developments. There is a clear emphasis on professional development, with all teaching staff required to obtain the University Teaching Qualification, which includes stringent requirements for teaching and English language proficiency. Students rate teaching quality positively. Staff members are approachable and committed, fostering good teacher-student ratios and intensive supervision. The teaching workload is well managed and distributed to balance work pressure, and staff appreciate the autonomy they have in course design, which enhances job satisfaction and ownership, ultimately benefiting course quality. The panel advises the programmes to continue the efforts to stabilize the teaching teams.

Considerations

The panel appreciates that the curriculum of both specializations of the INF bachelor is well-aligned with the intended learning outcomes, offering a thoughtfully structured framework through learning trajectories that balance flexibility and coherence. It is commendable that the programme maintains a strong theoretical foundation while providing meaningful opportunities for practical application. The I&E specialization admirably integrates computer science with business and economics, creating a well-balanced interdisciplinary profile that enriches students' academic and professional readiness. While the I&E curriculum provides solid fundamentals, the panel constructively recommends revisiting this specialization to create a stronger alignment with the overall programme learning outcomes, thereby strengthening its coherence and depth. The programme demonstrates commendable graduation rates that align well with national averages. Conversations with students reveal that the initial study workload can be challenging. The panel encourages the programme to further enhance its communication of study expectations to first-year and prospective students. By doing so, the programme can continue to empower students with a clear understanding of the curriculum demands, fostering their preparedness and supporting even greater study feasibility.

The panel commends the DSAI bachelor for its clearly structured and coherent curriculum, which aligns closely with its intended learning outcomes and vision. The thoughtfully designed learning trajectories expertly balance theoretical foundations with practical application, creating a programme that is challenging but feasible and fostering both academic rigour and real-world readiness. Students particularly value the freedom and flexibility they experience within assignments, which encourages personalized

learning and nurtures individual academic interests. The integration of hands-on experiences is a noteworthy strength, effectively developing students' programming and technical skills while cultivating essential professional competencies like client interaction and project management. Student feedback highlights the curriculum design that begins with a strong theoretical base and progressively connects theory to practice, enhancing their appreciation of the relevance and applicability of their knowledge. The interdisciplinary nature of the programme, uniting computing with domains such as psychology and artificial intelligence, is a distinctive asset that enriches the academic environment and broadens students' perspectives. The panel notes that the data science component appears somewhat underrepresented relative to the artificial intelligence component. The panel encourages the programme to enhance the visibility and emphasis of the data science aspects within the curriculum, thereby strengthening this vital pillar of the programme's interdisciplinary character.

The panel appreciates the thoughtfully structured and coherent CrIT curriculum, with its content closely aligned to the intended learning outcomes and the programme's inspiring vision. The programme offers an impressive variety of courses, internships, and exchange opportunities, providing students with rich avenues for academic and professional growth. Notably, the collaboration with the DSAI bachelor and the CS master is actively fostered, enhancing interdisciplinary learning. The programme excels in systematically developing both academic and professional skills through well-chosen didactic methods. Its strong research orientation is commendable, effectively integrating diverse research domains while empowering students to pursue individualized and flexible learning trajectories. The CrIT master shines through its small cohort size, which enables personalized feedback and dedicated support for each student. The collaborative work in diverse, multidisciplinary groups enriches students' perspectives and provides valuable opportunities to experience various roles. This intimate programme structure fosters a vibrant sense of community and strong bonds among students and staff, celebrating the rich diversity of backgrounds and enhancing collaboration and mutual support. The programme's low dropout rate is a testament to its effective retention strategies, and the occasional extended study duration often reflects students' enthusiastic involvement in engaging projects, highlighting their high motivation.

The panel commends the CS master for its comprehensive and richly detailed curriculum, featuring a wide range of specialized courses. The well-structured and coherent specializations provide students with deep expertise in their chosen fields, reflecting the programme's commitment to academic excellence. The panel suggests exploring the introduction of a common core curriculum. Such a core would establish a foundational knowledge base essential for all students, irrespective of their specialization or elective choices. This would align well with the programme's vision and further strengthen its academic coherence. The panel also acknowledges the programme's solid development of academic and professional skills throughout the curriculum. It welcomes the proactive steps taken to enhance labor market preparation and career orientation, and encourages the programme to continue building on these efforts to support student transitions from study to employment.

The panel values the proactiveness of the CS master in enhancing its feasibility. Noteworthy improvements include the thoughtful revision of specializations and the well-considered decision to discontinue the mandatory introductory research project, which together have streamlined the curriculum. Additionally, targeted measures to support students during their thesis projects demonstrate a strong commitment to study success. The panel positively acknowledges the programme's initiatives to support international students. The panel encourages the programme to explore creative ways to foster a stronger, shared sense of belonging among both Dutch and international students. Also, the panel advises the programme to continue enhancing student support services, especially in facilitating internships.

In summary, the panel appreciates the well-structured and coherent learning trajectories which balance theoretical knowledge with practical applications, and which offer students meaningful flexibility to tailor their individual study paths. The thoughtful designs and effective didactic approaches reflect programmes that are comprehensive and aligned with the intended learning outcomes. The interdisciplinary character, broad course options, internships, and exchange opportunities enrich the educational experience. The panel is content to see that the learning environment of the programmes offers a supportive and inclusive atmosphere and would like to emphasize the important role of the study advisors. Ongoing efforts to address administrative challenges and to strengthen student communities are welcomed by the panel and are expected to optimize student learning and success. The teaching staff exhibits professionalism, capability, and dedication, with ample opportunities for professional growth, and is well-equipped to support students in achieving the intended learning outcomes.

Conclusion

The panel concludes that the programmes meet standard 2.

Standard 3. Student assessment

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

Findings

System of assessment

The system of assessment within the LIACS programmes is based on the principle of constructive alignment. This means that course learning objectives and assessment formats are clearly specified and aligned, ensuring that assessments properly measure the intended learning outcomes. The programmes have a teachers handbook outlining rules for supervision, examination, thesis assessment, and handling fraud cases. Course learning objectives and assessment formats are specified in prospectuses that are updated yearly. Each course has a test matrix aligning learning outcomes with assessment components, often categorized by Bloom's taxonomy levels. The programmes apply a four-eyes principle for the creation of exams: when an exam is created, someone else from the teaching staff reviews it. Every six weeks, there is an education meeting where teaching staff members discuss, among others, assessment principles. In addition, teaching staff attends the annual education days, which are held among others to improve the alignment of learning goals and assessment methods.

The programmes apply a variety of assessment methods across courses, including written exams, multiple-choice exams combined with assignments, programming exams with semi-automated grading, project-based assessments, oral exams, presentations, and group discussions. Grading schemes are detailed for all substantial graded components. There is a growing use of digital testing and software tools to facilitate assessment and grading. While group assignments exist, the final grades predominantly reflect individual performance to mitigate risks of free-riding. Some courses have safeguarding systems to track individual contributions. Teaching staff states that students are satisfied with this type of assessment and it helps them in demonstrating enhanced learning outcomes. The workload of oral exams is, according to teaching staff, comparable to offline grading as the focus is on checking students' understanding, which can be assessed relatively quickly. While the fundamental principles and governance of assessment are consistent across the bachelor's and master's programmes, the master's programmes involve assessments of greater depth, complexity, and research orientation, with more extensive quality assurance and support mechanisms.

The rise of generative AI is recognized by all programmes as a challenge for take-home assignments. In response, the programmes have, among others, increased the number of oral exams. In addition, all programmes offer instructions on generative AI where students are familiarized with its workings. The principle applied is that works of students must be original. Generative AI use is generally not allowed unless it is necessary to achieve the learning objectives of a course. From the first year onward, some assignments explicitly permit the use of generative AI. Education meetings and working groups composed of teaching staff address the use of generative AI collectively.

Programme-specific, the CrIT master emphasizes creative application and research in interdisciplinary contexts, including exhibitions as part of the assessment and creative projects under time pressure. Here, the use of exhibitions and public presentations is more prominent than in the other programmes. The DSAI bachelor includes tools like the online Proof-Rondo proof checking tool and live programming tests to keep assessments scalable.

Based on the documentation and discussions during the site visit, the panel finds that the programmes have a sound assessment system that is well described. The programmes utilize constructive alignment and an appropriate variety of diverse assessment methods, and face common challenges such as group work contributions and the impact of generative AI. The presence of a comprehensive teachers handbook with rules and guidelines, detailed and extensive test matrices, and the application of the four-eyes principle in exam creation, support the reliability and validity of assessment. With the application of the peer review principle, the programmes follow up on one of the recommendations of the previous panel. Differences in assessment across programmes mainly arise from their disciplinary focus and level, influencing specific assessment formats like exhibitions in the CrIT master or live programming exams in the DSAI bachelor. The assessment matrices provide clear insight into where learning outcomes are achieved. Oral examinations are effectively used to verify the attainment of learning outcomes. The panel is happy to see that the programmes pay structural attention to the role of generative AI. The panel advises caution in the use of multiple-choice exams to maintain high assessment quality, although it understands the effectiveness and time-saving aspect of it.

Students from the INF bachelor mention that their academic writing skills could be better developed in the early stages of the programme. The panel understands that although the associated learning trajectory prepares them for this from the first year by building up writing skills, and although students are involved in peer review by observing other students who are writing their theses, they still struggle with writing. As a suggestion, the programme could see if implementing stricter guidance on the development of academic skills at the start of the programme is a possibility.

The use of assessment matrices, to assure the right level of assessment and the alignment of course objectives and course assessments, was one of the recommendations from the initial accreditation of the DSAI bachelor. The panel finds that the programme has successfully followed up on this recommendation.

Specifically for the CrIT master, the panel finds from the discussions with the lecturers that there is strong awareness of the opportunities and pitfalls of generative AI in assessment, with the programme acting as a proactive partner at the university level. Also, the panel sees that the feedback provided to students is generally more extensive than in the other programmes. The panel compliments the programme on these achievements, and would consider it logical for the CrIT master to share their insights and practices with the other programmes.

During the site visit, the panel spoke with CrIT staff and students about the evaluation of creative projects, which can be challenging due to subjective criteria that are involved. The panel sees that the assessment criteria sometimes include unusual elements (such as the personal background of students) and show limited consistency across student projects, especially concerning their creative aspects. Examinators tend to be more confident about the creative assessment than students and the Board of Examiners, with the latter two sometimes having questions on the subjective nature of the assessment. The programme addresses subjective assessment by clearly communicating goals and evaluation criteria both in writing and orally at the project's start. Also, students practice assessment by grading hypothetical projects and peer projects, which helps align expectations. The programme emphasizes that for some courses, like Computational Creativity, rigid rubrics are less effective due to the nature of creative exploration. Instead, a design brief with guiding directions is provided to frame the assessment. The panel welcomes the measures taken by the programme and advises continuous attention to the assessment of creative projects to keep ensuring the validity of this component of the assessment.

The panel asked the CrIT master staff and students specifically about the relatively large number of group-based assessment in relation to individual student performance. It found out that group work is often optional, and that the programme addresses the issue of free-riding by maintaining a good balance of group and individual projects. Students do not experience that many problems with free-riders, as teachers are strongly involved and oversee the whole process, and discussions are organized if students do not equally contribute. The panel was assured by these insights.

Bachelor and master thesis assessment
Both bachelor and master thesis assessments emphasize constructive alignment between the intended learning outcomes and the assessment criteria. Assessment criteria in all four programmes are thesis quality, execution of the project, and presentation and defence. Examiners use a standardized rubric for the master theses as a tool for thesis grading. A similar rubric for bachelor theses is currently being developed.

The panel views the procedures for assessing the bachelor's and master's theses as favourable. The assessment of theses has been standardized across programmes, leading to better motivated grades. Having multiple examiners involved enhances the reliability of the assessment. Before the site visit, the panel reviewed thesis assessments and largely concurred with the grades awarded, finding that these grades were generally well supported by the accompanying assessment forms. Sometimes, the panel found feedback to be either overly critical or lacking criticism relative to the final grade. The panel advises to continuously invest in increasing the quality of feedback and in calibrating among examiners.

Board of Examiners
All four programmes fall under the LIACS Board of Examiners (BoE), which is responsible for safeguarding the quality of assessment. The BoE oversees amongst others the appointment of examiners, ensuring that only qualified staff conduct assessments. An onboarding meeting for new lecturers has been instituted by the programme coordinators together with the BoE to familiarize them with, amongst other, the examination processes. The BoE has introduced a stricter division between ensuring and safeguarding assessment quality, with the BoE focusing on the latter, and the programmes on managing policy and procedures. The BoE organizes periodic quality control cycles to evaluate exams and assessment methods, ensuring they remain aligned with learning objectives and academic standards. Furthermore, the BoE conducts blind reassessments of sampled theses annually, checking for consistency and reliability in grading. Procedures are in place for handling re-sits and requests for additional facilities. There are detailed procedures for handling plagiarism. For instance, the programmes use Turnitin for assignments and employ MOSS (measure of software similarity) for checking syntax.

Based on the documentation and the conversations during the site visit, the panel finds that the Board of Examiners fulfils its legal duties in a professional manner. Addressing plagiarism remains challenging for examinators because they want to avoid unfair accusations of plagiarism, and it is difficult to actually prove fraud during exams and in code submissions. The rise of generative AI tools adds new challenges to detecting plagiarism, especially for take-home assignments. The panel understands this struggle and suggests improving expectation management regarding plagiarism, coupled with a stringent policy on plagiarism checks for code submissions.

The panel identifies as a point of attention the workload of the BoE, which the BoE describes as manageable yet vulnerable. The workload of the BoE is sometimes problematic due to understaffing of the faculty's administrative offices and the study advisor team, which places a higher workload on the BoE itself. The panel suggests to carefully manage the workload and responsibilities of the BoE. Implementing subcommittees could alleviate the workload by delegating specific tasks, such as plagiarism cases, appeals, or quality control of assessments, to dedicated groups. Finally, there is a divergence of views between the Board of Examiners and the Examination Appeals Board. The BoE handles a substantial number of student requests annually (668 in 2023-2024), including complex cases during the summer involving BSA and MoMi decisions (issues related to modern migration law), which are sensitive due to the personal circumstances of students. The BoE mentioned to the panel that, despite the efforts to carefully consider these cases, the CBE tends to overturn their decisions more frequently than the BoE finds acceptable. The panel finds that this issue warrants further investigation but lies beyond the scope of the current programme assessment.

Considerations

The panel is pleased to observe that the programmes have established a robust and thoughtfully articulated assessment system, which provides transparent insight into students' achievement of learning outcomes. This well-structured approach is supported by a comprehensive teacher's handbook containing clear rules and guidelines, as well as detailed and extensive test matrices, all of which significantly enhance the quality and coherence of the assessment framework. Particularly valued are the procedures for assessing bachelor's and master's theses, where the involvement of multiple examiners strengthens the quality and reliability of the assessment process. The Board of Examiners consistently and professionally fulfills its legal responsibilities, maintaining a clear quality control cycle that includes blind reassessments and the use of standardized rubrics for thesis evaluation. The use of oral examinations as a complementary tool to confirm attainment of learning outcomes is effectively implemented and appreciated by the panel. The programmes acknowledge the challenge of addressing plagiarism and have responded by increasing the use of oral exams and exploring innovative assessment methods to uphold academic integrity. The panel supports these efforts and suggests further improving expectation management regarding plagiarism, complemented by stringent policies on plagiarism checks for code submissions. Furthermore, the panel advises continuous investment in improving the quality of feedback and in calibration exercises among examiners to ensure consistent assessment standards.

The panel welcomes the proactive stance of the CrIT programme toward the assessment of creative projects, recommending ongoing attention to maintain the validity of this assessment component. The panel recommends careful management of the BoE's workload and responsibilities to safeguard sustained quality and efficiency.

Conclusion

The panel concludes that the programmes meet standard 3.

Standard 4. Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

Theses
Prior to the site visit, the panel studied 15 theses of each programme, including the assessment forms. Theses from all different specializations were included for the INF bachelor and the CS master. The panel generally found the reports to be of a high level for all programmes, convincingly showing that students realize the intended learning outcomes of their programme. The panel finds the variety of different topics covered impressive. Theses are characterized by a strong theoretical approach to both classical subjects and very recent topics, from various application areas. Especially for the master's programmes, the panel finds that the research component is clearly visible, demonstrating strong academic rigour. In addition, much of the thesis work within the master's programmes was of publishable quality.

Performance of graduates
Based on the documentation and the discussing during the site visit, the panel finds that INF bachelor graduates are well-prepared for professional practice and perform commendably in subsequent master's programmes. The panel notes that students from the I&E are not eligible to progress into every master's programme. The programme is aware that these students could lack some software-related knowledge for entering engineering universities, and therefore indicates to students that they can acquire that knowledge through elective courses if they have the ambition to continue in an engineering master's programme. At the same time, the programme stresses that students from this specialization do not often advance to computer science master's programmes. As the DSAI bachelor is a relatively young programme, it is too early to determine how graduates perform in their subsequent careers. However, due to its alignment with the KION framework, students are well-prepared to smoothly transition into follow-up master's programmes in Artificial Intelligence and Data Science.

Graduates from the CrIT master have diverse career opportunities across a broad range of fields. Due to the multidisciplinary nature of the programme, there is no single obvious career path upon graduation. To support students in exploring potential career options, the programme regularly organizes events where alumni are invited to share their professional experiences and provide insights into various possibilities. The panel warmly welcomes these initiatives. Graduates from the CS master enjoy excellent job prospects, which appear to vary depending on the specialization and whether the job searcher/position is international. Students find relevant employment quickly after graduation.

Considerations

The panel compliments the programmes with the high level of the theses. The panel is happy to see that graduates are well prepared for further academic progression and professional practice. The quality of theses and the academic or professional functioning of alumni show that students of all programmes realize the intended learning outcomes.

Conclusion

The panel concludes that the programmes meet standard 4.

General conclusion

The panel judges that the programmes meet all four standards. The panel's assessment of the programmes is therefore positive.

Recommendations

All programmes

1. Establish a strategic advisory board for the professional field to formalize and enhance the interactions with the professional field.
2. Embed study advisors structurally within the quality assurance framework.
3. Carefully manage the BoE's workload and responsibilities to safeguard sustained quality and efficiency.

B INF

4. Reassess the positioning of the specialization Informatica & Economie, potentially integrating it more closely with the DSAI bachelor or more clearly defining its status as a computer science programme, while still keeping its unique character to justify it as a separate specialization within computer science.

B DSAI

5. Make the data science elements more visible and prominent in the curriculum.

M CrIT

6. Keep attention to the assessment of creative projects to keep ensuring the validity of this component of the assessment.

M CS

7. Consider establishing a common core curriculum to enhance coherence and focus.
8. Explore options to build a stronger student community in which Dutch and international students develop a sense of belonging, and both feel supported while finding their way in the job market.

Assessment faculty-wide specialization Business Studies

Organization

The Business Studies specialization is a MSc specialization of Leiden University's Faculty of Science organized and hosted by LIACS and currently offered as a specialization of seven master programmes: Astronomy, Biology, Bio-Pharmaceutical Sciences, Chemistry, Life Science and Technology, Mathematics, and Physics. Starting from the academic year 2025-2026, the Computer Science programme at LIACS will also offer this specialization. LIACS provides the programme director, education support staff, Programme Committee, and part of the teaching staff for Business Studies. The LIACS Board of Examiners is mandated by the individual programmes to safeguard the quality of the examination. Admission responsibilities remain with the Boards of Admissions of the individual programmes. To ensure strong embedding within LIACS, most Business Studies courses are taught by members of the Software and AI in Business research cluster of LIACS. Additionally, a strategic collaboration exists with the Department of Business Studies at the Leiden Law School, whose staff members teach several courses in the specialization.

Standard 1. Intended learning outcomes

Findings

The Business Studies specialization is designed for students in the sciences who aspire a career in management, entrepreneurship, or industry. The specialization aims to equip students with foundational analytical frameworks and practical skills to effectively analyze business-related challenges and contribute to informed managerial decision-making within knowledge-intensive organizations or emerging technology ventures. This specialization integrates discipline-specific scientific expertise from the MSc programme of the student with essential business and managerial competencies, addressing the increasing demand for professionals who combine scientific knowledge with business insight.

Based on the documentation and discussions during the site visit, the panel finds that the intended learning outcomes tie in with the orientation of the programme and are methodologically sound in their formulation. The outcomes are generally formulated in a broad manner and oriented towards a business setting. The master's level aspect is clearly recognized in the third and fifth learning outcomes, but is less explicitly evident in the other learning outcomes. The panel recommends to formulate the master's level more sharply. Additionally, the panel suggests adding a learning outcome that explicitly links the learning outcomes to the disciplinary component, emphasizing the ability to solve practical problems from a scientific perspective within the relevant domain.

Considerations

The Business Studies specialization is thoughtfully designed for MSc students in sciences who aim for careers in management, entrepreneurship, or industry. The panel appreciates that the intended learning outcomes are methodologically sound and appropriately oriented towards a business setting. The panel recommends sharpening the articulation of the master's level across all learning outcomes, ensuring they fully capture the advanced academic and professional expectations of a master's specialization.

Standard 2. Teaching-learning environment

Findings

Curriculum

The curriculum of students that follow this specialization is structured into two main components: a disciplinary segment and a Business Studies segment, allowing for a flexible and individualized study pathway. The disciplinary component typically encompasses 60 to 80 EC consisting of research-oriented courses and a thesis project aligned with the student's primary master's programme. The Business Studies segment ranges from 40 to 60 EC and is composed of mandatory courses, elective courses, and a business internship, collectively designed to impart foundational and applied business knowledge and skills.

The goal of the internship is for students to put into practice and further develop the knowledge and skills they have learned in their courses. During the internship, students are trained to become subject matter experts in the field of their internship and gain valuable hands-on experience applying scientific expertise to real-world business challenges. This experience helps them develop effective business strategies and prepares them for the job market. Internships typically last between 3 to 6 months and may be conducted at companies or organizations both in the Netherlands and abroad. The internship is jointly supervised by a company supervisor and a LIACS supervisor, with the latter responsible for the final assessment and grade. Recent improvements for the Business Internship assessment include the introduction of student cohorts with dedicated supervisors, colloquia for presenting findings, and clear timelines to improve guidance and reduce supervisor workload.

The mandatory Business Studies courses cover essential management functions such as strategy, finance, operations, and marketing, alongside research methodologies that underpin the business internship. The curriculum is delivered in a block format, with courses concentrated in intensive periods to facilitate in-depth engagement and interaction, promoting active learning through case discussions, guest lectures, and practical business exercises. This structure also nurtures multidisciplinary collaboration by bringing together students from diverse scientific backgrounds, fostering peer learning and networking opportunities valuable for entrepreneurial and cross-sectoral ventures.

From the discussion with the students, it becomes clear to the panel that students appreciate the specialization for its comprehensive introduction to business fundamentals, starting with a foundational course that covers all the basics. They value the practical aspects of the programme, which enable them to apply what they learn in real-life contexts. Many students come from a research-focused bachelor’s background and find the specialization beneficial for gaining insights into how to translate scientific innovations, such as medicines, into marketable products, thereby deepening their understanding of industry dynamics. The specialization offers in-depth and challenging courses, like Strategy & Technology, which provide extensive information and help students critically analyze key business elements.

The panel asserts that the specialization allows students to combine their disciplinary knowledge with core business and management knowledge and skills, enabling a multidisciplinary approach to problem-solving and encouraging joint endeavors such as startups. The panel finds that multidisciplinary collaboration is more implicitly than explicitly embedded in the curriculum. This may lead to missed opportunities for students to develop skills in integrating knowledge from multiple disciplines. Therefore, the panel suggests to explicitly incorporate interdisciplinarity as a curricular element.

Learning environment

The learning environment of students is designed to be engaging and compelling by combining theoretical instruction with mini case studies and examples drawn from a variety of industries, culminating in a significant comprehensive case study. This approach caters to diverse student groups by selecting broadly applicable cases and covering a wide range of topics, ensuring relevance to all. Additionally, the programme assesses the prior knowledge of students at the outset, distinguishing between beginner and advanced levels. For topics that are new to students, the teaching focuses on core concepts to build a solid foundation. Students work in mixed groups with diverse backgrounds.

Throughout their programme, students receive guidance from a study advisor from their own disciplinary programme. The programme considers to appoint a dedicated Business Studies study advisor to enhance student support and alleviate the current supervisory load on programme coordinators. The internship component poses challenges due to the variability in availability and preferred duration of internships in the business sector. Students are advised to proactively seek internship opportunities, and institutional efforts are underway to appoint an internship coordinator to strengthen connections with potential internship providers.

In the discussion with the students, it is indicated that they perceive the programme committee as an active body that facilitates evaluation meetings to discuss programme-wide issues involving teachers and general matters. The committee includes three student members who are part of the learning community, ensuring student representation. Students feel heard by the committee, exemplified, for instance, by the change in scheduling a retake exam following their input.

Students have access to internship supervisors and can approach them when needed. At the same time, they experience internship supervision as sometimes passive and more on the sidelines. Although this is partly mitigated by the presence of company supervisors who also provide supervision, they feel more active guidance and support would be beneficial.

Based on the documentation and the site visit, the panel finds that the learning environment takes into account the diversity of the student group, ensuring that students receive tailored instruction that meets their skill level and facilitates effective learning. The courses incorporate recent and relevant examples, helping students relate theoretical concepts to current developments. The formation of mixed and diverse groups often leads to engaging and insightful discussions and collaborations, leveraging the multidisciplinary nature of the student body.

The panel observes that the internship is a component of professional and academic learning, providing students with real-world experience. The actual role of academic supervisors during internships is in some cases limited, placing most responsibility on the individual student and external company supervisors. This can reduce the academic quality assurance of the internship experience and limit the feedback loop between academic learning and practical application. The programme recognizes this and is working on improving supervision by extending the team of LIACS supervisors to reduce workload and provide better feedback and support to students. More involvement could mean more frequent check-ins, clearer communication channels between academic and company supervisors, and structured feedback mechanisms. From the documentation and discussions, the panel learnt that safeguarding that internships meet master-level academic requirements is left to the individual supervisors. The panel advises to ensure this more centrally, and suggests to review and enforce criteria to ensure that all internships meet pre-established academic requirements. In addition, the panel recommends to establish a clear policy regarding the role of academic supervisors and to implement a structure to ensure that this role is consistently fulfilled.

The panel further finds that international students face challenges in securing internships, as the responsibility for finding these opportunities primarily rests with the students themselves and they have more trouble navigating the Dutch landscape than Dutch students. The programme should increase support for international students in the internship search process by providing more structured guidance and actively facilitating connections with potential internship hosts.

Teaching staff
The teaching staff associated with the Business Studies specialization primarily consists of members from the Software and AI in Business research cluster within LIACS, ensuring that courses are delivered by specialists with relevant expertise. External lecturers, often practitioners in industry or related sectors, contribute to the programme, enriching the curriculum with practical insights. All teaching staff hold the University Teaching Qualification (BKO), which includes proficiency in English (BKE), aligning with the university's standards for didactic competence and language skills.

The panel finds that the teaching staff is qualified and well-integrated in LIACS. Strategic collaboration with the Department of Business Studies maintains and improves the quality of education in the specialization.

Considerations
The panel appreciates the tailored learning environment that effectively enables students to blend their disciplinary expertise with essential business and management knowledge, fostering a multidisciplinary approach to problem-solving and encouraging collaborative ventures. The focus of the programme on multidisciplinary collaboration is commendable. The mixed group of students supports a rich learning environment. The panel values the internship component as a vital element of professional and academic development, offering students meaningful real-world experience. Furthermore, the panel recognizes the teaching staff as highly qualified and well-integrated within LIACS. The strategic collaboration with the Department of Business Studies is seen as a significant asset, contributing to the continuous maintenance and improvement of the educational quality within the specialization.

The panel suggests to explicitly incorporate interdisciplinarity as a curricular element. With regard to the internship, more guidance and support during the internship search process and during the internship itself would be beneficial to students.

Standard 3. Student assessment

Findings
The assessment system for the Business Studies specialization follows the policies and procedures established for all LIACS programmes. Assessment methods include exams, assignments, presentations, and project reports. The assessment methods used vary depending on the course, allowing flexibility in evaluation. The assessment of the internship is done using a rubric that evaluates organizational and business knowledge, analytical and professional skills, and business competencies.

From the discussions with the students, the panel recognizes that students experience assessment in a way that emphasizes understanding rather than simply providing correct answers. Most exams and courses use open questions where there is not necessarily a right or wrong answer, focusing more on the depth of comprehension. The programme clearly communicates what topics will be covered and the types of questions students may expect, making the assessment transparent. Students find the grading criteria clear and straightforward and appreciate the rubrics provided to guide them. Feedback is an integral part of the

process and is given early in the courses, ensuring students understand how their summative work will be evaluated.

Based on the documentation and discussions during the site visit, the panel finds that the assessment system supports students in realizing the intended learning outcomes. The internship provides hands-on experience applying scientific expertise to real-world business challenges. The panel observed that, in its current form, the internship is not effectively functioning as a capstone project that connects the intended learning outcomes. The recommendation is therefore to redesign the internship to better serve as a concluding academic project. According to the panel, there is potential to establish a stronger connection between the internship and the disciplinary component of the master's programme. This would involve structuring the internship as a more interdisciplinary research project, where students are required to genuinely integrate both business and scientific perspectives within the context of their internship experience. The panel observes the need to improve the internship process and outcome and came to understand that the programme is working on dedicated supervisors and clear timelines for students doing their internship.

Furthermore, the panel came to understand that it is not mandatory to have two academic supervisors for the internship, creating the risk that the internship report is reviewed by only one academic staff member. The panel suggests to require the involvement of at least two academic supervisors for each master's internship to ensure a proper four-eyes assessment of the internship report.

Considerations

The panel appreciates that the assessment system supports students in achieving the intended learning outcomes. The panel observes the need to improve the internship process and outcome and welcomes recent initiatives to make such improvements.

Standard 4. Achieved learning outcomes

Findings

The realized learning outcomes by students are demonstrated by both the course examinations and the internship, which serves as the final project of the specialization. Eight internship reports were examined by the panel. These were generally acceptable as internship report, although (as discussed in standard 3), the panel found that their use as capstone projects for the entire Business Studies specialization could be improved. This could include for instance the demonstration of key learning outcomes such as synthesizing scientific and business perspectives, and the ability to independently analyze business research problems, critically engage with relevant literature, formulate testable hypotheses, and conduct and reflect critically on research. The panel thinks this is partially due to the limited involvement of academic supervisors in the process, and the format of the internship reports, which does not fully provide students with the opportunity to demonstrate all their knowledge and skills. This suggests that a different approach to the guidance, structure and assessment of the internship might be necessary (see standard 3).

In the discussion with the students, they express that they generally feel well-prepared for the job market through their challenging curriculum that involves developing marketing strategies, performing market research, and understanding the business environment. They gain valuable skills in conducting literature research and critically evaluating sources. Additionally, students benefit from direct contact with researchers, for example, through internships or start-ups, which enhances their practical experience and industry insight.

Considerations

The hands-on exposure combined with theoretical and applied learning equips students effectively for real-world business challenges and managerial decision-making. It is positive that students feel strongly positioned for successful careers in their chosen fields. The panel recommends that the programme improves the internship process, which should result, among others, in higher quality of the internship reports.

Recommendations

1. Sharpen the articulation of the master's level across all learning outcomes.
2. Increase the support for international students in the internship search process.
3. Redesign the internship to better serve as a concluding academic project, where students are required to genuinely integrate both business and scientific perspectives within the context of their internship experience.
4. Establish a clear policy regarding the role of academic supervisors and implement a structure to ensure that this role is consistently fulfilled.

Appendix 1. Intended learning outcomes

Bachelor's programme Informatica
Graduates of the Bachelor Informatica:
a. have knowledge and understanding in the basic courses, current concepts and methods of computer science;
b. are able to independently study further relevant subjects and to acquire the necessary skills for a follow-up study that presupposes a high level of autonomy;
c. have sufficient theoretical and practical skills in computer science to conduct research under (strict) supervision;
d. possess the ability to think critically, to abstract, and to analyse a scientific problem;
e. have insight into the way in which current hypotheses can be tested through experiments, and how acquired knowledge can lead to the formulation of theories;
f. have insight into the position of different sub-areas within Computer Science and their relation to adjacent scientific areas;
g. have the ability to communicate with research colleagues about research results;
h. have sufficient knowledge and understanding of the social and societal role of computer sciences to be able to reflect on scientific and societal problems from acquired knowledge and insight;
i. have the ability to apply basic mathematics, algorithmic principles and computational theory in the modelling and design of software systems in a way that shows the understanding of the compromises involved in design choices;
j. are capable of designing, implementing and evaluating a process, component or program on a computer system alone or in a team, while meeting the desired needs of the user;
k. are also able to analyse a problem and identify and define the computational requirements needed for the solution;
l. have basic knowledge of the functioning of a computer at hardware level.

Graduates of the specialization Informatica:
m. are able to apply design and development principles in the construction of software systems of different complexity;
n. understand the interplay between theory and practice;
o. can describe how operating systems are structured in general;
p. have sufficient insight into the quantitative principles of the design of computer systems;
q. possess knowledge of programming languages and underlying principles;
r. have an overview of the most important subfields of foundation of computer science, artificial intelligence and data science.

Graduates of the specialization Informatica & Economie:
s. integrate theoretical and applied knowledge on economics and finance with computational methods;
t. are able to model business processes and explore financial processes and data with methods from data science;
u. can apply design and development principles in the construction of software systems of varying complexity.

Bachelor's programme Data Science and Artificial Intelligence
Graduates with a degree in Data Science and Artificial Intelligence (DSAI):

a. have knowledge and understanding in the basic courses, current concepts and methods of Computer Science, Data Science, and Artificial Intelligence;
b. are able to independently study further relevant subjects and to acquire the necessary skills for a follow-up study that presupposes a high level of autonomy;
c. have sufficient theoretical and practical skills in Computer Science Data Science, and Artificial Intelligence to conduct research under (strict) supervision;
d. have the ability to think critically, to abstract, and to analyse a scientific problem;
e. have insight into the way in which current hypotheses can be tested through experiments, and how acquired knowledge can lead to the formulation of theories;
f. have insight into the position of different sub-areas within Data Science, Artificial Intelligence and Computer Science and their relation to adjacent scientific areas;
g. have the ability to communicate with research colleagues about research results;
h. have sufficient knowledge and understanding of the social and societal role of computer sciences and AI to be able to reflect on scientific and societal problems from acquired knowledge and insight;
i. are able to apply basic mathematics, algorithmic principles and computational theory in the modelling and design of software and intelligent systems in a way that shows the understanding of the compromises involved in design choices;
j. are capable of designing, implementing, and evaluating an intelligent agent, a process, component, or program on a computer system alone or in a team, while meeting the desired needs of the user;
k. are able to analyse a problem as well as to identify and define the computational requirements needed for the solution;
l. have basic knowledge of the functioning of a computer at hardware level;
m. are able to understand, apply, formulate, and validate models of knowledge representation, to analyse them, and reasoning about them;
n. are able to apply knowledge from Algorithmic Problem Solving, Cognitive Science, Data Science, Natural Language Processing, Intelligent Autonomous Agents and Multi-Agent Systems, Human-Computer Interaction, Knowledge Representation and Reasoning, and Machine Learning.

Master's programme Computer Science
General programme learning outcomes
Graduates of the MSc programme Computer Science have attained the following general learning outcomes:
a. theoretical and practical skills in more than one specialist area of computer science such that they can carry out research under overall supervision;
b. the ability to make an independent analysis of scientific problems, analysis of relevant specialist literature, formulate verifiable hypotheses, and set up and carry out research and critical reflection on one's own research and that of others;
c. the ability to interrelate and integrate various areas of computer science;
d. the ability to present clearly, verbally as well as in writing, one's own research results, and the ability to communicate with colleagues and to present their research results as a contribution to a congress or as (part of) a scientific publication;
e. sufficient understanding of the social and societal role of computer science to be able to reflect upon it and in part consequently to come to an ethically sound attitude and corresponding execution of one's professional duties;
f. have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

Specific learning outcomes Advanced Computing and Systems
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialisation Advanced Computing and Systems have obtained:
g. in-depth knowledge in programming high performance computers and embedded systems, and building multimedia systems.

Specific learning outcomes Artificial Intelligence
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialisation Artificial Intelligence have obtained:
h. in-depth knowledge on deep and reinforcement learning methods, understanding the principles of evolutionary computation and its application for optimisation algorithms.

Specific learning outcomes Bioinformatics
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialisation Bioinformatics have obtained:
i. in-depth knowledge of the core concepts of bioinformatics, including methods in computational biology, the design and mining of bio databases, the process and analysis of images, and the construction of mathematical models of biological systems.

Specific learning outcomes Data Science
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialisation Data Science: Computer Science have obtained:
j. in-depth knowledge of data management, have a thorough understanding of algorithmic analysis of data;
k. able to develop new data models and techniques and execute data analysis.

Specific learning outcomes Foundations of Computing
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialization Foundations of Computing have obtained:
l. in-depth knowledge of verification methods and modelling techniques, and understanding of advanced data structures and algorithms.

Specific learning outcomes Computer Science and Education
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialisation Computer Science and Education have obtained:
m. all qualifications necessary for teaching all years of secondary education and technical and vocational training (for 12-18 year-olds).

Specific learning outcomes Computer Science and Science Communication & Society
In addition to the general achievements, graduates of the MSc programme Computer Science with the specialisation Computer Science and Science Communication and Society have obtained:
n. knowledge of the relationship between science & society through science communication frameworks and transdisciplinary perspectives;
o. experience with these frameworks and skills to apply them in practice, e.g. in science journalism, visual communication, or in informal science education;
p. basic skills in performing science communication research independently.

Master's programme Creative Intelligence & Technology
General Faculty of Science master programme learning outcomes

1. theoretical and practical skills in more than one specialist area (including computer science/artificial intelligence, creative and performative arts, and relevant aspects of philosophy, cognitive science, and linguistics), such that they can carry out research under overall supervision;
2. the ability to make an independent analysis of scientific problems, analysis of relevant specialist literature, formulate verifiable hypotheses, and set up and carry out research and critical reflection on one's own research and that of others;
3. the ability to interrelate and integrate various areas of computer science, artificial intelligence, creative and performative arts with relevant aspects of philosophy, cognitive science, and linguistics;
4. the ability to present clearly, verbally as well as in writing, one's own research results. This includes the presentation of their research results as a contribution to a congress or as (part of) a scientific publication and the ability to communicate with colleagues;
5. sufficient understanding of the social and societal role of academia, especially computer science/artificial intelligence and the creative and performative arts, to be able to critically reflect upon it and in part consequently to come to an ethically sound attitude and corresponding execution of one's professional duties;
6. have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

Programme-specific learning outcomes
In addition to the above general achievements, graduates of the MSc in Creative Intelligence & Technology have:
7. formed an understanding of the fundamental principles and organisation of academia, and of the importance of creativity and playfulness in academic research;
8. knowledge and skills in computer programming and in the use of various media and technologies within virtual and physical environments;
9. the ability to communicate with colleagues/peers in science (via e.g. a conference contribution or scientific publication) as well as with a wider audience (via e.g. an exhibition, performance, public event, or in popular-scientific writing);
10. the ability to act as independent researchers and thinkers with a critical attitude.

Master's specialization Business Studies
Graduates of a master programme with specialization Business Studies have attained the following learning outcomes:
a. theoretical knowledge and practical skills in the core areas of business and management;
b. the ability to interrelate and integrate various scientific disciplines with business and managerial concepts, enabling a multidisciplinary approach to problem-solving;
c. the ability to independently analyze business research problems, critically engage with relevant literature, formulate testable hypotheses, and conduct and critically reflect on research, demonstrating a synthesis of scientific and business perspectives;
d. communication skills tailored for the business environment, enabling effective collaboration and engagement with diverse stakeholders;
e. practical business skills, encompassing hands-on experience in applying scientific expertise to real-world business challenges, and developing effective business strategies

Appendix 2. Programme curriculum

Bachelor's programme Informatica

B1. Curriculum Overview - Informatica

Research / Skills		Systems / Hardware	Programming / Software	Theory	Data / AI	Mathematics
Year 1	Semester 1	Digital Systems Design	Programmeermethoden	Foundations of Computer Science	Studying & Presenting	Calculus 1
					Orientatie Informatica	Linear Algebra 1
	Semester 2	Programming Techniques	Algoritmiek	Logic	Databases	Calculus 2
				Probability Theory		Linear Algebra 2
Year 2	Semester 1	Computerarchitectuur	Datastructuren	Automata Theory	Concepts of Programming Languages	Statistics
	Semester 2	Operating Systems & Networks	Security	Computability	Complexity	Artificial Intelligence
				Research Methods in CS		
Year 3	Semester 1 30 ECTS Elective Space, LDE Minor or Study Abroad	Compiler Construction	Human Computer Interaction and Information Visualization	Quantum Computing*	Computer Vision	Natural Language Processing
		Multiprocessor Programming	Video Game Making		Natural Computing	
		Computer Graphics	Internet Governance		Data Protection	
	Semester 2		Requirements Engineering	Program Correctness	Reinforcement Learning	Data Science
		Machine Learning	Software Engineering	AI and Ethics	Bachelor Thesis Project	
Extra-curricular		CTF: Cyber Security in Practice	Programmeer-wedstrijden*	AI & Robotics Challenge	Bold courses are mandatory. Courses marked * are not taught yearly.	

B1. Curriculum Overview - Informatica & Economie

Research / Skills		Programming / Software	Core Computer Science	(Business) Economics	Data / AI	Mathematics
Bold courses are mandatory.				I&E Integration courses		
Year 1	Semester 1	Introduction to Programming	Essentials of Computer Systems	Foundations of Computer Science	Studying & Presenting	Calculus 1
					Orientatie Informatica & Economie	Linear Algebra 1
	Semester 2	Algorithms and Data Structures	Corporate Finance	Logic	Databases	Calculus 2
				Probability Theory		Linear Algebra 2
Year 2	Semester 1	Software Development	Technology and Operations Management	Micro-economie	Business Technology Research	Statistics
				Macro-economie		
	Semester 2	Requirements Engineering	Security	Business-IT Alignment	Strategy	Machine Learning
				Research Methods in CS		
Year 3	Semester 1 12 ECTS Elective Space	Human Computer Interaction and Information Visualization	Integration: Project Management	Seminar Business Information Systems	Marketing in the 21st Century	Entrepreneurship: Theory and Practice
		Video Game Making	Data Protection	Internet Governance		AI for Business
	Semester 2	Software Engineering	AI and Ethics	Bachelor Thesis Project		Data Science

Bachelor's programme Data Science and Artificial Intelligence

Research / Skills		Programming / Software	Core Computer Science	Data / AI	Cognition & Interaction	Mathematics
Year 1	Semester 1	Introduction to Programming	Essentials of Computer Systems	Foundations of Computer Science	Studying & Presenting	Calculus 1
					Orientation AI	Linear Algebra 1
	Semester 2	Algorithms and Data Structures	Databases	Logic	Introduction to Cognitive Science	Calculus 2
				Probability Theory		Linear Algebra 2
Year 2	Semester 1	Software Development	Languages and Computation	Symbolic AI	Human-Agent Interaction	Statistics
	Semester 2	Security	Neural Computing	Reinforcement Learning	Cognition & Computation	Machine Learning
					Research Methods in AI	
Year 3	Semester 1 30 ECTS Elective Space, (LDE) Minor or Study Abroad	Concepts of Programming Languages	Human-Computer Interaction and Information Visualization	Generative AI	Cognitive Neuroscience	Natural Language Processing
		Video Game Making	Cognitive Modelling	Cognitive Robotics	Natural Computing	Computer Vision
	Semester 2 6 ECTS Elective Space	Program Correctness			Applied Data Science & Explainable AI	
		Software Engineering		AI and Ethics	Bachelor Thesis Project	
Extra-curricular		CTF: Cyber Security in Practice	AI & Robotics Challenge	N.B.: Bold courses are mandatory. Courses marked * are not taught yearly.		

Master's programme Computer Science

Course	EC
All specialisations	
Master Class + Master's Thesis Research Project	30 or 42
Advanced Computing and Systems	
Cloud Computing	6
Cryptographic Engineering	6
Embedded Systems and Software	6
High Performance Computing	6
Multimedia Systems	6
System and Software Security	6
Artificial Intelligence	
Evolutionary Algorithms	6
Introduction to Deep Learning	6
Modern Game AI Algorithms	6
Reinforcement Learning	6

Algorithmic Artificial Intelligence	
Automated Machine Learning	6
Multicriteria Optimization and Decision Analysis	6
Human-Centered Artificial Intelligence	
AI in Society	6
Computational Creativity	6
Bioinformatics	
Advances in Data Mining	6
Bio-Modeling	6
Biological and Biomedical Informatics	6
Evolutionary Algorithms	6
Image Analysis with Applications in Microscopy	6
Introduction to Deep Learning	6
Data Science	
Advances in Data Mining	6
Information Retrieval	6
Introduction to Deep Learning	6
Reinforcement Learning	6
Social Network Analysis for Computer Scientists	6
Text Mining	6
Foundations of Computing	
Computational Models and Semantics	6
Foundations of Software Testing	6
Modern Game AI Algorithms	6
Proof Formalisation	6
Quantum Algorithms	6
Software Verification	6
Computer Science and Education	
Education component (ICLON)	60
Computer Science and Science Communication and Society	
SCS component (IBL)	60

Master's programme Creative Intelligence & Technology

Curriculum 2024-2025	
Core Courses Semester 1	**EC**
Field Trip	1
Creative Programming	6
HCI & Information Visualization	6
Research Fundamentals	3
Playful & Creactive Science	6
Strategies in Creative and Performing Arts	3
Hardware & Physical Computing	3
Meta Media	2
Core Courses Semester 2	
Sound, Space & Interaction	6
Non-Human Cognition	4
Artifical Creatures	4
Sciences and Humanities	4
Exhibition: Science to Experience	12

Curriculum 2024-2025	
Courses Semester 3	
Accent courses (2 or 3 out of 5):	
- *AI in Society*	6
- *Computational Creativity*	6
- *Research Seminar: Artificial Intelligence*	6
- *Scientific Narration & Visualization*	3
- *Video Games for Research*	6
Electives	10-19
Portfolio	1
Graduation Lab	1
Courses Semester 4	
Graduation Project	30

Students are expected to take the core courses, with a total of 92 EC including the Graduation Project. The remaining 28 EC are obtained through a combination of accent courses and elective courses. Students must take minimally 2 and no more than 3 accent courses.

Masters's specialization Business Studies

Year 1		Year 2	
Semester 1	*Semester 2*	*Semester 3*	*Semester 4*
Disciplinary courses (~30EC)	Disciplinary thesis project (~30EC)	Marketing Science (3EC)	Business Internship (20 or 30EC)
		Operations Management (4EC)	
		Research Methods (5EC)	
		Strategic Financial Management (3EC)	
		Strategy and Technology (5EC)	
		Electives (0-20EC)	

Appendix 3. Programme of the site visit

Monday 16 June 2025

13.00 – 13.30	Arrival and welcome (incl. lunch)
13.30 – 14.00	Panel preparation
14.00 – 15.00	Interview management
15.00 – 15.30	Break / internal meeting panel
15.30 – 16.15	Interview B Data Science and AI students + alumni
16.30 - 17.15	Interview B Data Science and AI teaching staff
17.15 - 18.00	Internal meeting panel

Tuesday 17 June 2025

08.45 – 09.15	Arrival and preparation
09.15 – 10.00	Interview M CrIT students + alumni
10.15 - 11.00	Interview M CrIT teaching staff
11.00 – 11.15	Break
11.15 – 12.00	Tour
12.00 – 13.00	Lunch
13.00 – 13.45	Interview B Informatica students + alumni
14.00 – 14.45	Interview B Informatica teaching staff
14.45 – 15.30	Break / internal meeting panel
15.30 – 16.00	Interview M Computer Science students + alumni
16.30 – 17.15	Interview M Computer Science teaching staff
17.15 – 18.00	Internal panel meeting

Wednesday 18 June 2025

08.45 – 09.15	Arrival and preparation
09.15 – 09.45	Interview Business Studies students + alumni
10.00 – 10.30	Interview Business Studies teaching staff
10.30 – 10.45	Break
10.45 – 11.15	Interview study advisors and coordinators
11.15 – 12.00	Interview exam board
12.00 – 13.00	Internal panel meeting (incl. lunch)
13.00 – 13.30	Final management meeting
13.30 – 15.00	Development dialogue / theme sessions
15.00 – 16.30	Internal panel meeting
16.30 – 17.00	Oral feedback

Appendix 4. Materials

Prior to the site visit, the panel studied 15 theses each from the bachelor's programmes Informatica and Data Science and Artificial Intelligence, as well as the master's programme Computer Science and Creative Intelligence & Technology. 8 internship reports were considered from the faculty-wide specialization Business Studies. Information on the theses is available from Academion upon request.

The panel also studied other materials, which included:

- Self-evaluation reports INF, DSAI, CrIT (including student chapter), CS (including Business Studies)
- Student chapter INF + DSAI, CS
- Course and Examination Regulations bachelor + appendices for each programme
- Course and Examination Regulations master + appendices for each programme
- Assessment plans
- Year reports Board of Examiners LIACS
- Course materials
- Student publications