Computer Science

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This report was finalized on February 17, 2014.

Report on the master's programmes Computer Science, ICT in Business and Media Technology of Leiden University

This report takes the NVAO's Assessment framework for limited programme assessments as a starting point.

Administrative data regarding the programmes

Master's programme Computer Science

Name of the programme:	Computer Science
CROHO number:	60300
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	Computer Science Theory and Advanced Technologies; Core Computer Technologies; Bioinformatics (Joint programme with TU Delft); Computer Science and Science Based Business (SBB); Computer Science and Science Communication and Society (SCS)
Location(s):	Leiden
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2014

Master's programme ICT in Business

Name of the programme:	ICT in Business
CROHO number:	60205
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	None
Location(s):	Leiden
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2014

Master's programme Media Technology

Name of the programme:	Media Technology
CROHO number:	60206
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	None
Location(s):	Leiden
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2014

The visit of the assessment committee Computer Science to the Faculty of Science of Leiden University took place on 7 and 8 October 2013.

Administrative data regarding the institution

Name of the institution:	Leiden University
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	conditionally positive

Quantitative data regarding the programmes

The required quantitative data regarding the programmes are included in Appendix 5.

Composition of the assessment committee

The committee that assessed the master's programmes Computer Science, ICT in Business and Media Technology consisted of:

- Prof. dr. J. Paredaens (chairman), retired professor in Database Research, Antwerp University;
- Prof. dr. L. Bijlsma (member), professor in Educatie en Software Constructie en Vice-Dean of the Faculty of Management, Science and Technology, Open University;
- Prof. dr. ir. B. Preneel (member), professor in Information Security, KU Leuven;
- Prof. dr. S. Mullender (member), Director of the Network Systems Laboratory at Bell Labs, Antwerp and professor Systems Research, University of Twente;
- Dr. C. Nevejan, tenured researcher, Participatory systems, Dept. of Technology Policy and Management, Delft Technical University;
- P. Boot BSc (student member), master student Computer Science, Utrecht University.

The committee was supported by M. Maarleveld, MSc, who acted as secretary.

Appendix 1 contains the curricula vitae of the members of the committee.

Working method of the assessment committee

The assessment of the master's programmes Computer Science, ICT in Business and Media Technology was part of an assessment cluster. In total, the committee assessed 26 programmes from ten universities: Open Universiteit, Delft University of Technology, University of Groningen, Eindhoven University of Technology, Utrecht University, University of Amsterdam/VU University Amsterdam, Radboud University Nijmegen, Leiden University and University of Twente.

The assessment committee Computer Science 2013 consisted of 10 members:

- Prof. dr. J. Paredaens (chair), retired professor in Database Research, Antwerp University;

- Prof. dr. L. Bijlsma (member), professor in Education and Software Construction and Dean of the Faculty of Computer Science, Open Universiteit;
- Prof. dr. ir. B. Preneel (member), professor in Information Security, KU Leuven;
- Prof. dr. J. van den Herik (member), professor in Computer Science, Tilburg University;
- Prof. dr. ir. K. De Bosschere (member), professor in Computer Science, Ghent University;
- Prof. dr. S. Mauw (member), professor in Security and Trust of Software Systems, University of Luxembourg;
- Prof. dr. S. Mullender (member), Director of the Network Systems Laboratory at Bell Labs, Antwerp and professor Systems Research, University of Twente;
- Prof. dr. ir. W. Van Petegem (member), associate professor and Director Teaching and Learning, KU Leuven;
- P. Boot BSc (member), student Computer Science, Utrecht University;
- R. Verbij BSc (member), student Computer Science, University of Twente.

Dr. Nevejan was added to the committee for the visit to Leiden as an expert on Media Technology.

Preparation
The committee held a preliminary meeting on April 26, 2013. During this meeting the committee was instructed about the accreditation framework and the programme of the upcoming assessments. A vice-chair for each visit was appointed and the Domain Specific Framework for Computer Science was set (see Appendix 2).

To prepare the contents of the site visits, the coordinator first checked the quality and completeness of the Critical Reflection Reports prepared by the programmes. After establishing that the Reports met the demands, they were forwarded to the participating committee members. The committee members read the reports and formulated questions on their contents. The coordinator collected the questions and arranged them according to topic.

As well as the Critical Reflection Report, the committee members read a selection of ten theses for each of the master's programme. The theses were randomly chosen from a list of graduates of the last two completed academic years within a range of grades.

Site visit
A preliminary programme of the site visit was made by the coordinator and adapted after consultation of the committee chairman and the programme coordinator of Leiden University. The timetable for the visit in Leiden is included as Appendix 6.

Prior to the site visit the committee asked the programmes to select representative interview partners. During the site visit, meetings were held with panels representing the faculty management, the programme management, alumni, the programme committee and the Board of Examiners. Meetings were also held with representatives of the students and teaching staff. Well in advance of the visit, the committee approved a list of the selected interview partners.

During the site visit, the committee examined material it had requested; an overview of this material is given in Appendix 7. The committee gave students and lecturers the opportunity – outside the set interviews – to speak informally to the committee during a consultation hour. No requests were received for this option.

The committee used the final part of the visit for an internal meeting to discuss the findings. The visit was concluded with a public oral presentation of the preliminary impressions and general observations by the chair of the committee.

During the site visit, it became clear that the committee did not have enough information to establish a profound opinion about the quality and assessment of the thesis work of the master's programme Media Technology. The committee therefore paid a second visit to Leiden on Januari 30 2014, to study and discuss additional information about assessment and graduation procedures of this master programme.

Report
Based on the committee's findings, the coordinator prepared a draft report. This report was presented to the committee members involved in the site visit. After receiving approval, the draft report was sent to the faculty with the request to check it for factual inaccuracies. The comments received from the programme were discussed with the committee chairman. The final version of the report was sent to the committee members for a final check. Subsequently the definitive report was approved and sent to Leiden University.

Decision rules
In accordance with the NVAO's Assessment framework for limited programme assessments (as of 22 November 2011), the committee used the following definitions for the assessment of both the standards and the programme as a whole.

Generic quality
The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

Unsatisfactory
The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

Satisfactory
The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

Good
The programme systematically surpasses the current generic quality standards across its entire spectrum.

Excellent
The programme systematically well surpasses the current generic quality standards across its entire spectrum and is regarded as an (inter)national example.

Summary judgement

Master programme Computer Science

Standard 1
The educational profile has a strong emphasis on intelligent algorithms, multimedia, bioinformatics and embedded computer systems, reflecting the focus of the LIACS (Leiden Institute for Advanced Computer Science) research groups. Education and research are strongly linked. The master's programme in Computer Science offers five specializations. The different specializations have specific features and aims, but they all fit within its main vision of 'smart computing for science and society'. *Computer Science and Advanced Technologies* and *Core computer Technologies* are fundamental computer science specializations. *Bioinformatics* is a joint programme with TU Delft. It combines developments in the scientific fields of computer science and biomedical sciences. Students in the master programme *Science Based Business (SBB)* learn to engage in and initiate new business on the interface of science, society and industry. In *Science Communication and Society (SCS)*, students are prepared for a professional career in areas such as science journalism, science communication, science policy making or public relations related to science. The (planned) integration of the two specializations Computer Science Theory and Advanced Technologies and Core Computer technologies will lead to a stronger profile of the master programme in Computer Science. The general intended learning outcomes are sufficient, but too general in nature. The committee advises to make them more specific towards each specialization. The intended learning outcomes relate to the Dublin descriptors indicating that the programmes offer master level education.

Standard 2
The vision on education is translated in to interesting curricula with specific didactical characteristics that will support the realization of the goals formulated under standard 1. The strength of the programme is the direct link to the research groups, providing students a rich research environment. The different courses form a relevant and coherent set of choices for the students. Nearly all students enroll in the first three specializations and the committee advises to review the additional value of the specializations in SBB and SCS. Student/staff ratio is good, but more growth in student numbers will put pressure on it in the future. The quality of staff members is good and students are very positive about the programme. Students are also positive about the number of contact hours and study load. The committee has concluded that suggestions for improvements, made in the last visitation, have been taken seriously and improvements have been made. According to the committee, the programme specific quality assurance is sufficient, but it would benefit from the suggestions made on the size and focus of the committee and its role in curriculum changes.

Standard 3
The assessment system is well organized, different types of examination are well-chosen to assess knowledge and skills that are required. The Board of Exams is aware of its role and responsibilities in assuring the quality of assessments, but the composition of the committee raised questions on its independence and this should be solved. The success rates for the master programme in computer science are good and there is no dropout, which is considered very good by the committee. Students are very successful in finding suitable jobs after their study, both in PhD positions and in business. The committee is positive about the quality of theses and the assessment of the theses.

The committee assesses the standards from the Assessment framework for limited programme assessments in the following way:

Master's programme Computer Science:

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	satisfactory
General conclusion	satisfactory

Master's programme ICT in Business

Standard 1
The Master ICT in Business has the focus on the application of IT in a business. It aims to deliver graduates that can play a crucial role in bridging the gap between the (information) technology domain and the business/societal application domain. Students are educated within a stimulating research environment where they get exposed to state-of-the-art cases and realistic problems of the business world. Interdisciplinary collaborations with companies and institutions are strongly supported, and students are involved in such activities in many different ways during their study. The programme combines LIACS' research strengths in the relevant areas of ICT with a significant business component. Next to the general intended learning outcomes, the committee appreciates that specific learning outcomes have been formulated that are more explicit and programme specific. They relate to the Dublin descriptors indicating that the programme offers master level education. The programme has a scientific focus, and has an orientation on business, management and organizational aspects. The programme prepares for PhD positions and addresses the development of skills and competencies that are necessary for a working professional.

Standard 2
The vision on education is translated into a well-structured curriculum with specific didactical characteristics that will support the realization of the goals formulated under standard 1. The technical and business aspects are in balance and integration between technical and business aspects are explicitly dealt with within courses. The programme accommodates for students with different backgrounds and qualifications, as the curriculum is offered in three different variants, for students with a bachelor degree in computer science, specialization Informatica & Economie; for students with a bachelor degree in computer science or related subjects; and for students with significant working experience. Adding this post experience programme has led to growth in student numbers. The programme is now close to being understaffed in the opinion of the committee. The quality of staff members is good. Over 75% of the lecturers are active scientists, the other 25% are valuable for the programme given their relevant experience in the business world. Students are in general positive about the lecturers, the programme, contact hours and study load. The committee has concluded that suggestions for improvements, made in the last visitation, have been taken seriously and improvements have been made. According to the committee the programme specific quality assurance is sufficient, but it would benefit from the suggestions made on the size and focus of the committee and its role in curriculum changes.

Standard 3
The assessment system is well organized, different types of examination are well-chosen to assess knowledge and skills that are required. The Board of Exams is aware of its role and

responsibilities in assuring the quality of assessments, but the composition of the committee raised questions on its independence and this should be solved. Success rates are sufficient, but could improve. Specific measure are taken to improve them. Dropout is minimal. Students are very successful in finding suitable job after their study, mostly at major IT consultancies and IT services companies, and IT related jobs in the financial sector, professional services or telecom. Only a few students chose a PhD position. The committee was positive about the quality of theses and the assessment of the theses.

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	satisfactory
General conclusion	satisfactory

Master's programme Media Technology

Standard 1
Compared to regular Computer Science master programmes, the programme Media Technology focuses more on the application of technology than on the technology itself. In Media Technology, computer science is used as a research tool to bridge the gap between art and technology. The programme strongly collaborates with the Academy for Creative and Performing Arts ('Academie der Kunsten') in the Faculty of Humanities. Creativity is seen as an important factor in scientific innovation and this is translated to the programme's vision on education to simulate students to become independent, self-propelling creative researchers. According to the committee, the programme has a strong academic orientation. The committee concludes that the vision of the programme is clear, as are its objectives and intended learning outcomes. During the site visit, the committee learned their vision is not only strong on paper; it is embodied by the lecturers/researchers responsible for the programme, and the students and alumni as well. The committee believes Media Technology is a unique programme in the Netherlands, and a welcome addition to existing fields of research and education.

Standard 2
The vision on education is translated into a well-structured curriculum with specific didactical characteristics that will support the realisation of the goals formulated under standard 1. The committee found that the course descriptions show a prominent scientific orientation. The programme describes itself as methodological rather than as a subject-specific master programme. Several fundamental courses are designed to challenge students to develop their own research project. The committee believes this is done very well. Students are in general very positive about the lecturers, the programme, contact hours and study load. The number of students has grown, and Media Technology is close to being understaffed in the opinion of the committee. Although the committee has established that it does not lead to problems, the quantity of staff needs attention to maintain the level of quality and student support as is given at the moment. The quality of staff members is good. According to the committee the programme specific quality assurance is sufficient, but it would benefit from the suggestions made on the size and focus of the committee and its role in curriculum changes.

Standard 3
The assessment system is well organized, different types of examination are well-chosen to assess knowledge and skills that are required. The Board of Exams (BoE) is aware of its role and responsibilities in assuring the quality of assessments, but the composition of the BoE

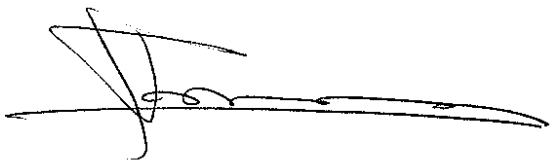
raised questions on its independence and this should be solved. Success rates are sufficient, but could improve. Specific measures are taken to improve them. Dropout is minimal. Students are very successful in finding suitable jobs after their study and a high percentage of graduates proceed in PhD trajectories, clear indications of the quality of the programme. Students graduate based on a creative work and /or a scientific text and the research process. During the first visit the committee only had the scientific texts to assess. During the second visit, additional information was made available for a substantial number of theses from recent years. The committee has seen some very good theses and agrees with the programme management that the master programme stimulates the good students to do innovative and creative research. In the theses of these students the success of this unique programme can clearly be identified. The committee, however, also saw graduation theses, that didn't show that the students had achieved the level that is expected for a master's degree.

The committee established two problems. First, in several cases the committee felt the scientific text did not reflect the entire research project the student was evaluated on. The programme was unable to provide essential information regarding the creative work and the process. Secondly, the scientific text alone did not show sufficient evidence of scientific research according to the committee. The committee has pointed out three essential improvements for the assessment system of master theses and three recommendations for further improvement. Together with the programme director, they have been further operationalized into specific measures which already have been implemented in January 2014. They entail guidelines for documentation of the entire project documentation on the research, its process and specific criteria for the scientific texts, to reflect the scientific character of the master programme. The committee is confident the measurements will lead to improvement within a short period of time.

Standard 1: Intended learning outcomes	good
Standard 2: Teaching-learning environment	satisfactory
Standard 3: Assessment and achieved learning outcomes	unsatisfactory
General conclusion	unsatisfactory

The chair and the secretary of the committee hereby declare that all members of the committee have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: February 17, 2014



Prof. dr. J. Paredaens

M. Maarleveld MSc

Description of the standards from the Assessment framework for limited programme assessments

Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Explanation:
As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme.

1.1 Findings

The requirements of the discipline of Computing Science have been described by the Joint Task Force for Computing Science Curricula in their (draft) report Computing Science Curricula 2013. The committee has established that both the master programmes in Computer Science and ICT in Business meet these requirements. The master programme in Media Technology has a unique profile that only partly fits to the domain specific framework. It challenged the committee to assess this programme, but the discussions during the visitation proved to be very helpful to understand the specifics of the programme. The results of these discussions are described in this chapter. For each master programme the specifics of the profile, intended learning outcomes, level and orientation are discussed.

Programme objectives and profile
The master programmes Computer Science, ICT in Business and Media Technology have the following general objectives: to impart sufficient knowledge, understanding and skills as to enable the graduate to contribute independently, at an academic level and in an original manner to recognizing, coming up with and solving issues in an area of the natural sciences, to discuss this contribution with colleagues, to inform non-specialists in a clear and unambiguous manner on conclusions and considerations that form the foundation of the study, and to successfully follow a PhD programme within the discipline and its marginal areas.

Master programme Computer Science
The programme offers five specializations: Computer Science and Advanced Technologies; Core computer Technologies; Bioinformatics (joint programme with TU Delft); Computer Science and Science Based Business (SBB) and Computer Science and Science Communication and Society (SCS). Most students are enrolled in the first three specializations.

The critical reflection describes that the educational profile of the programme has a strong emphasis on intelligent algorithms, multimedia, bioinformatics, and embedded computer systems. This reflects the focus of LIACS on researching new algorithms with applications in life sciences and other sciences, as well as industry. Within Leiden University, education and research are strongly linked to provide students and stimulating research environment where they are involved in state-of-the- art research. Besides the education in algorithms and theory, students are also introduced into practical applications. The programme supports (interdisciplinary) collaborations with other research institutes as well as companies; this gives

students the opportunity early on to acquire skills in applying science. LIACS is actively expanding both the academic and industrial collaborations.

Especially the specialisations SBB and SCS have a practical orientation. According to the critical reflection, students in the master programme Science Based Business learn to add value to organizations and in particular engage in and initiate new business started on and from the interface of science, society and industry. The committee is unsure if the programme is sufficiently different from the master programme ICT in Business, that is offered within LIACS as well. Both seem to be interdisciplinary programmes, combining computer science and business. The Science Communication and Society specialization prepares students for a professional career in areas such as science journalism, science communication, science policy making or public relations related to science.

The specialization in Bioinformatics aims to train students in scientific research directed towards bioinformatics, biomedical and biotechnological areas, with a focus on data modelling and data analysis towards advancing the field. It aims at graduates who are able to conduct research in national and international research environments at universities, in hospitals, and in the biotech industry. According to the committee, it is a very valuable addition to the Computer Science programmes.

The specializations in Computer Science and Advanced Technologies and the specialization in Core Computer Technologies are both fundamental programmes. Students specialize in algorithms, foundations of software technology, technology and innovation management, computer systems and imagery and media. The programmes for both specializations are the same, as are the intended learning outcomes (see below). In the future both specializations will be integrated into one. Although students did not seem to mind two names for basically the same programme, the committee agrees integration will make the landscape of specializations more clear.

Under its motto Smart Computing for Science and Society, the different specializations within Computer Science at LIACS all qualify students for a scientific career in academia as well as for a professional career in industry. The committee believes the programmes have attractive profiles. Within LIACS students can choose from a broad range of strong programmes and specializations.

Master programme ICT in Business
According to the critical reflections, the Master ICT in Business has the focus on the application of IT in a business. It combines the (information) technology domain and the business/societal application domain. According to the critical reflection, students are educated within a stimulating research environment where they get exposed to state-of-the-art cases and realistic problems of the business world. Interdisciplinary collaborations with companies and institutions are strongly supported, and students are involved in such activities in many different ways during their study. The critical reflection further states that the programme's goal is to educate students on fundamental and state-of-the-art concepts of information technology, finding a balance between emerging developments from the field and academic rigor in accepting validity and learning about the ambiguity of going from theory to practice. The committee believes it is valuable that the programme combines LIACS' research strengths in the relevant areas of ICT with a significant business component. The committee believes this to be a strong profile. The integration of computer science and Business, and bridging the gap between them is both important and relevant.

Master programme Media Technology
According to the critical reflection, Media Technology is a master programme in which students are stimulated to become independent, self-propelling, creative researchers. During the site visit, the specifics have been discussed extensively, with lecturers and students. The committee has learned that a special feature of the programme, is its recognition of creativity as an important factor in scientific innovation. Lecturers describe the programme as a place where students, artists and researchers are allowed to formulate their own scientific questions, regardless of existing larger research agendas. Students feel encouraged to translate their personal inspirations and curiosities into research projects. The committee has learned that students are stimulated to express their research results in manners other than through scientific articles (students create installations, applications, games, stories, performances, books, et cetera. To achieve this, the curriculum focuses on creative exploration and on the understanding of science and technology. The committee concludes that the vision of the programme is clear, as are its objectives. During the site visit, the committee learned their vision is not only strong on paper; it is embodied by the lecturers/researchers responsible for the programme, and the students and alumni as well.

Positioning the programme in the field of Computer Science was slightly difficult. Compared to regular Computer Science master programs, the programme Media Technology focuses more on the application of technology than on the technology itself. Yet, the programme is embedded in the research endeavours of LIACS and the Faculty of Science as a whole, as natural sciences form the basis of its vision and method. In the critical reflection, its position within LIACS is explained as Computer Science acts as an accelerant of scientific innovations, computer technology offers the ultimate and most flexible research tool, and computer technology facilitates small and independent research. The programme strongly collaborates with the Academy for Creative and Performing Arts ('Academie der Kunsten') in the Faculty of Humanities. The critical reflection explains that, compared to media studies master programs (e.g. New Media & Digital Cultures at Utrecht University), Media Technology is more creating and pro-active than observing and reflective. It also says that, when compared to arts academies (for example the Design Academy Eindhoven), Media Technology is much more scientific in its aims and intend learning outcomes. During the site visit, the programme was compared to leading programmes in the field, such as MIT MediaLab and ZKM | Zentrum für Kunst und Medientechnologie in Germany. This made it clear to the committee that the programme positions itself as a scientific programme bridging art and technology, using Computer Science as a research tool. The committee agrees that this focus on creativity, art and technology make it difficult to place the programme in a specific discipline. Other options, such as information science and art programmes have been discussed but the committee agrees with the programme that in fact, positioning this programme within LIACS makes most sense. It is strongly related to computer science, and it offers maximum flexibility. The committee believes this is a unique programme and a welcome addition to existing fields of research and education.

Intended learning outcomes
Article 2.3 in the Course and Examination Regulations (OER) of the Faculty of Science states that the following achievement levels apply to the master programmes in Computer Science, ICT in Business and Media Technology:

- theoretical and/or practical skills in more than one specialist area of the discipline such that (s)he can carry out research under overall supervision;

- 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;
- the ability to interrelate and integrate various areas of the discipline;
- 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 his/her research results as a contribution to a congress or as (part of) a scientific publication;
- sufficient understanding of the social role of the natural sciences to be able to reflect upon them and in part consequently to come to an ethically sound attitude and corresponding execution of one's professional duties.

For each master programme, additional achievement levels or competencies are described.

Master programme Computer Science
For the specialisations Computer Science and Advanced Technologies, Core computer Technologies and Bioinformatics, the intended learning outcomes are the same and there are no additional intended learning outcomes.

Taking into account a shorter research training period for the specialisations Science Based Business and Science Communication & Society, the following additional intended learning outcomes apply:

For Computer Science and Science Based Business specialisation

- sufficient basic knowledge and understanding of strategic and marketing management, financial management, project management, organizational science, patents and quality management;
- experience in setting up and carrying out organizational research within a company, in connection with the research specialization.

For Computer Science and Science Communication & Society specialisation

- knowledge and understanding of modern information and communication technology;
- experience in science communication;
- knowledge of ethical, historical and social aspects in the area of the natural sciences.

Master programme ICT in Business
Additional competences specific to the Master ICT in Business are:

- Graduates have acquired sufficient basic knowledge and understanding of strategic, marketing, financial and project management as well as organizational science to operate effectively on the Business – IT interface.
- Graduates have acquired specific knowledge and theoretical as well as practical skills that enable them:

    - to align the IT function of a firm with the business functions;
    - to design, build, implement and maintain applications in a business environment;
    - to innovate business, to develop business plans or to transform business based on IT.

The committee appreciates the additional learning outcomes to the general learning outcome, as they are more explicit and programme specific. The committee agrees with the intended learning outcomes for this programme.

Master programme Media Technology
In addition to the final qualifications in the OER, the programmes aim to educate students who: (upon graduation)

- are capable of functioning autonomously within an academic and or research environment, with particular knowledge of the possibilities that information technologies can play in the research process;
- have aptitude in all phases of the traditional 'research chain', i.e. forming research questions, choosing appropriate methods, and communicating research output;
- realize the value of creative thought within the scientific process, and have been exposed to various manifestations of creative science;
- are ready to function at the PhD entry level; or typically find their way in the creative industry.

The committee believes the general intended learning outcomes of the three master programmes are sufficient, but they are too general in nature. The committee appreciates the additional programme specific learning outcomes as they are more explicit and programme specific. Three specializations within the master programme Computer Science did not have additional intended learning outcomes. The committee advises to make the intended learning outcomes for these specialisations more specific as well. The committee concludes that for all three master programmes the intended learning outcomes are in line with the programmes' vision and the committee agrees with them.

Level and Orientation
The committee agrees with the critical reflection stating that the intended learning outcomes relate to the Dublin descriptors indicating that all three master programmes are at master level.

Master programme Computer Science
The committee has established that the specializations Computer Science Theory and Advanced Technologies, Core Computer Science, and Bioinformatics have a very strong scientific focus and prepare students for a PhD position very well. The committee questioned whether students are prepared sufficiently for the professional field as well. During the site visit the committee learned that students feel prepared for the professional field, and are confident they will have no problems in finding a suitable job, both in research and in the professional field because they can work at an academic level. The committee has established that the other two specializations (Science Based Business and Science Communication & Society are academic, but are in nature also focussed on the professional field. The committee believes it is positive the programmes offers both specializations with a strong focus on research, and specialisations with a focus on the professional field.

Master programme ICT in Business
The committee has established that the programme has a scientific focus, and it has an orientation on business, management and organizational aspects. The committee believes the programme prepares both for PHD positions and addresses the development of skills and

competencies that are necessary for a working professional. The committee is very positive about the combination of focus on research and the professional field.

Master programme Media Technology
The committee has established the programme has a strong academic orientation. It prepares students for PhD entry level. According to the critical reflection it prepares graduates for performing autonomous scientific research, including the determination of suitable research aims and methods. Critical, interdisciplinary and creative thought are combined with a natural-science approach to science. The committee has learned that the programme does not aim to limit potential employment to scientific research, but prepare students for professional field as well, especially in the so-called creative industry. Students feel confident they will find a suitable job upon graduation. The committee agrees with the programmes' scientific orientation.

1.2 Considerations

Within LIACS, a great variety of master programmes and specialisations are offered. The committee felt challenged to asses three different master programmes, especially the master programme in Media Technology, as it did not fit entirely within the domain specific framework. Based on several discussions during the site visits and the critical reflections, the committee has learned both the specifics that make the programme in Media Techology different from other programmes in computer science, and the specifics that vouch for its position within LIACS. With this in mind, the committee has made its assessment, and feels confident about them.

The master programme in Computer Science, in particular the specializations in Computer Science Theory and Advanced Technologies, and Core Computer technologies represent a very fundamental approach to Computer Science. The specializations in Bioinformatics is interdisciplinary and represents development in the scientific fields of both Computer Science and biomedical sciences, while both the specializations in Science Based Business (SBB) and Computer Science and Science Communication and Society (SCS) aim for a practical application of scientific knowledge.

Based on the critical reflection, the committee noticed overlap between the specialization Science Based Business and the master programme ICT in Business. The committee advises to review its additional value compared to the other programmes offered within LIACS. The committee believes that the programmes' vision and objectives are clear and coherent. The committee appreciates that the different specializations have specific features and aims but they all fit within LIACS' main vision of 'smart computing for science and society'. The committee also believes that the (planned) integration of the two specializations Computer Science Theory and Advanced Technologies, and Core Computer technologies, and the review of SBB and SCS specializations will lead to a stronger profile of the master programme in Computer Science.

The committee finds that the master programme in ICT in Business has a clear profile and the committee agrees with its objectives. The committee is positive about the interdisciplinary education bridging the gap between information technology and business/societal value, within a research environment.

Extensive discussions were needed to fully understand the position of the master programme in Media Technology. Once this position had been explained during the site visit, the

committee focused once again on the profile and objectives of the programme and was impressed with them. The committee concludes that Media Technology is a unique programme in the Netherlands, but it can in terms of vision be compared to programmes from leading institutions like the MIT Media Lab. Creativity is seen as an important factor in scientific innovation and this is translated to the programme's vision on education to simulate students to become independent, self-propelling creative researchers. It is also unique as it uses Computer Science as a research tool to bridge the gap between art and technology. The profile and objectives are unique and they are embodied by the researchers and teachers responsible for the programme.

One set of general intended learning outcomes have been put into place for all three master programmes? The committee believes they are sufficient, but too general in nature. This is why the committee appreciates the additional programme specific learning outcomes. Three specializations within the master programme Computer Science did not have additional intended learning outcomes. The committee advises to make the intended learning outcomes for these specialisations more specific as well.

For all programmes, the intended learning outcomes relate to the Dublin descriptors indicating that the programmes offer master level. The committee has established that all programmes have a strong academic orientation. The level of attention for the professional field varies between the programmes and specializations but it is visible in all programmes, according to the committee.

1.3 Conclusion

Master's programme Computer Science: the committee assesses Standard 1 as **satisfactory**.
Master's programme ICT in Business: the committee assesses Standard 1 as **satisfactory**.
Master's programme Media Technology: the committee assesses Standard 1 as **good**.

Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Explanation:
The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

2.1 Findings

The committee has studied the curricula of all three programmes. During the site visit, all course materials and course descriptions were made available to the committee and the committee has reviewed a selection of courses during the visit. The committee also had access to the minutes of relevant committees. The committee was very pleased with the quantity and quality of all information presented during the site visit. This chapter discusses the curricula and its didactical approaches. It also discusses staff, programme specific quality assurance, student intake and enrolment, contact hours, study load, student support and programme-specific services.

Curriculum and relations with intended learning outcomes

Master programme Computer Science
The master programme Computer Science includes five specializations:

- Computer Science Theory & advanced technologies;
- Core computer science;
- Bioinformatics;
- Science Based Business;
- Science Communications & Society.

The curricula of the different specializations in master programme Computer Science differ in set up, but they are all designed around the key concept of education embedded within research. An overview is presented in appendix 4. Based on an overview in the critical reflection that shows that all intended learning outcomes are addressed in the curriculum. The committee has reviewed the overview, course descriptions, and course materials and the committee concludes that the intended learning outcomes are all addressed. In general, the committee noticed there is no specify attention for the role of Computer Science in society. The committee regards topics such as ethics, privacy and security very important for students to get familiar with during their studies and recommends to address them.

The two *specializations Computer Science Theory and Advanced Technologies and Core Computer Technologies* share the same general programme, and differ only with respect to the students' choice of research topic in the master thesis. The programme relates directly to the research areas of LIACS. This ensures students are offered state of the art knowledge embedded in a research environment. Students have a large degree of freedom in choosing six credit courses. The study advisor supports the students with the composition of their individual programme. In the first year, students can decide to do a software project or project study. The second year consists of research within a LIACS research group. The committee has reviewed the different courses students can choose from and believes they form a relevant and coherent

set of choices for the students. The committee appreciates the direct link of courses to the research groups.

The *specialization Bioinformatics* is jointly offered with the Faculty of Electrica Engineering, Mathematics and Computer Science (EEMCS) of Delft University of Technology (TUD). Its curriculum in the first year consists of four fixed mandatory courses reflecting the focus of the specialization, a mandatory methodology course and 20 ECTS specialisation courses, which will prepare students towards a research topic. The support program (12 EC) is tailor made for each student. It accommodates for students with different backgrounds to acquire the necessary multidisciplinary basic bioinformatics knowledge. The second year consists of a research project (15 EC) and the Master's thesis project 3 (45 EC). The committee is of the opinion this is a well-structured curriculum.

The curriculum of the *specialization in Computer Science and Science Based Business* consists of courses on science-based business in the first year, and computer science courses and research in the second year. Students can choose between two combinations of courses, either tailored towards established companies, or towards generating new business. For the internship students choose a business internship or an assignment in the context of a start-up project or company. Additional courses can be selected in consultation with the study advisor. According to the committee the curriculum is interesting, but as stated under standard 1, the committee questions its additional value to the master programme ICT in business.

The curriculum of the specialization in *Computer Science and Science Communication and Society* consists of courses on science communication and society in the first year, and Computer Science courses and research in the second year. The courses on science communication are a mandatory course on fundamentals of science communication and society, a mandatory training period, which can be in journalism, museology or new media and includes a written report and an oral presentation. In addition, students have a choice of courses within Computer Science, courses in communication and a small communication master's thesis and a corresponding communication research project. The Computer Science curriculum in the second year consists of course work in Computer Science and a research project and thesis with one of the research groups at LIACS. The committee finds it an interesting programme and it is positive about the setup of the programme.

Master programme ICT in Business
The master programme ICT in Business is organized around a number of core courses on ICT and business and business management fundamentals that address the required fundamental knowledge of business, with practical examples from the IT world. The committee reviewed course descriptions and course material, together with an overview that in the critical reflection shows that all intended learning outcomes are addressed in the curriculum. The committee has concluded that all intended learning outcomes are addressed in the curriculum,

The committee believes the role of computer science in society is slightly underexposed in the curriculum. The critical reflection states that specific socio-political topics are dealt with in the programme, but not in specific courses. They are: Intercultural perceptions and cultural / personal attitudes in the courses on Change Management, Strategy and Innovation Management; Corporate / Personal Values in the course on Organizing and ICT planning; and Political pressures in the course on Project Management. The committee believes these topics are relevant and the committee is positive the topics are addressed, but the committee would like to see more attention for important themes, such as ethics, privacy and security.

In the first year, the curriculum offers a number of fixed courses and seminars, supplemented by an integration course. A set of courses on Business Management Fundamentals (33EC) brings students to a basic level of business understanding. It includes a management simulation and courses on strategy, marketing communications, financial accounting, corporate finance, management science and managing innovation. In addition, a number of courses deal with the sociotechnical aspects of IT in business, for example managing change, managing people, organizing, behavioural decision making. In a set of advanced courses on ICT and Business (33 EC), students focus on the interrelationship between organizational processes, management and ICT.

In the second year, the education in business, ICT and research foundations is continued. Several electives (9 EC) allow specialization for those interested in a consultancy career, in entrepreneurship or in (external/foreign) functional broadening (e.g. finance). The main part of the second year is spent on courses to prepare students for conducting research and the master thesis research project (34 EC). This research is often of interdisciplinary nature, performed in collaboration with another research institute or, most often, a company.

The critical reflection reports that the programme accommodate for students with different backgrounds and qualifications. The curriculum is offered in three different variants:

1. For Computer Science bachelors, a programme is designed to complement technical knowledge and skills with management oriented aspects. This is the standard programme as described above. The amount of EC is not evenly divided over two years. 66 EC are offered in the first year, and the second year is 54 EC. The committee has not found indications that uneven dived credit over the two years causes any problems.
2. For Hybrid bachelors, a programme was designed with more electives, as these students have knowledge and experience in combing technical and business elements.(for example students with a Computer Science & Economics bachelor). The curriculum consists of:

    - Business Management Fundamentals (21 EC)
    - Core courses: ICT and Business (27 EC)
    - Electives (Specialization courses 27 EC)
    - Research focused: (45 EC)

3. For students with substantial work experience, a post experience programme is designed. According to the critical reflections, students have been working in technical functions and aspire managerial and leadership functions, which motivates them to join the program. Students with professional experience follow in essence a similar pattern as the Computer Science curriculum with the following main components:

    - Specialisation courses (40 EC)
    - Specialisation courses or software project or project study (20 EC)
    - ICT in Business research project (17 EC)
    - ICT in Business master's research project (43 EC)

The committee is positive about the curriculum of this programme. The technical and business aspects are in balance. The committee understands from the course descriptions that within most courses, integration between technical and business aspects are explicitly dealt with. The committee especially likes the possibilities to accommodate for students with different backgrounds. The committee believes the mentioned socio-political topics are

relevant, but the committee suggest adding specific topics on the role of Computer Science in society, such as . ethics, privacy and security.

Master programme Media Technology
The Media Technology consists of compulsory courses (55 EC) in the first year and free electives (15 EC), the semesterproject (20 EC) and an individual research project (30 EC) in the second year.

Compulsory courses: semesters 1 and 2 (the first year) consist of compulsory courses. The first semester starts with a visit to the Ars Electronica festival and conference. According to the critical reflection three categories of compulsory courses are offered:

- courses with an emphasis on knowledge and insight (e.g., Web Technology and Language & Text);
- courses with an emphasis on obtaining skills (e.g., Creative Research and Meta Media);
- courses that originate directly from research work by the lecturer (e.g., Research Seminar Artificial Intelligence and Sound, Space & Interaction).

During the second year, 15 EC of the curriculum consists of free electives. All courses have to be on master level. For a maximum of 5 EC in the electives, an exception can be made if the course on bachelor level has added value to the student in preparing on a specific topic in the master thesis research project. The committee has no problem with this, if the choice is well motivated and regulated.

In the third semester (second year), students partake in the 'Semester Project:' a group project that starts with a 'kick-off' session and is finalized with a public exhibition of resulting student works.

The fourth semester (second year) is meant for the individual graduation research project. It also starts with a kick-off session and is finalized with a program-wide event in which graduating students present their research results.

The committee found that the course descriptions show that scientific orientation is prominent and leading in the set-up of the Media Technology programme. The programme describes itself as methodological rather than as a subject-specific master programme. The curriculum offers several fundamental courses, and it is designed to challenges students to develop their own research project. The committee believes this is done very well. The course "Creative Research", which is described as addressing 'the essence of science, its principles its organization models and culture', is a valuable course according to the committee. The committee appreciates that the different elements in the programme are clearly defined by 'kick-off sessions' and final presentations. It concludes that the programme is well-structured. The committee has established that the curriculum relates to the objectives of the programme and the Dublin descriptors. The relation to the intended learning outcomes has not been made explicit in the critical reflections, but based on the course descriptions and course materials, the committee is of the opinion that they are well addressed in the curriculum.

Didactical approach
For all three programmes the general didactical principle is to embed education in a research environment. For each programme several didactical principles are formulated.

Master programme Computer Science
The critical reflection reports the following didactic aspects of the curricula:

- Courses typically involve practical assignments (homework), often to be executed in groups (two or more students), and an exam.
- Seminars train students in studying literature, acquiring novel scientific literature, writing essays, preparing and giving presentations, working in groups and conducting group discussions.
- An optional software project or project study 4 (18 EC, 1st year) aims at introducing a student to a specific field of science either by implementing scientific software and running systematic experiments with it, or by reading about and summarizing the state of the art in a specific subject. The deliverable can be a software system or a written report.
- Research components where students learn to formulate, execute and report scientific research under the supervision of a researcher.
- Master class (for second-year students) introduces project evaluation standards, is used for discussing standards of scientific work, and gives students the opportunity to discuss their research with other students.

The Bioinformatics specialization also provides tutors that train students in multidisciplinary knowledge. SBB and SCS specializations both offer an internship providing students with work experience in a company or organization.

The committee believes the didactical aspects are in line with the general didactic principle of the programmes of embedding education in research.

Master programme ICT in Business
The didactic aspects as reported for the Computer Science curricula apply to the programme ICT in Business as well, with the addition of 'Capstone cases'. Capstone cases aim at introducing students to analysing IT issues in a real life case by applying acquired theory from the courses combined with literature research onto a specific situation. The deliverable is mostly an analysis report but occasionally also a design, mock-up or software system. The committee is positive about the didactic aspects; they are in line with the intended learning outcomes of the programme.

Master programme Media Technology
According to the critical reflection, learning by doing is an important principle within the Media Technology program, as students are required to continuously realize projects. Besides realizing projects, students participate in:

- plenary classes ('hoorcolleges'), sometimes combined with lab assignments;
- short intense courses completed over several full days;
- research seminars focusing on a specific scientific theme;
- regular conference visits, and an annual common visit to a conference to start the program;
- writing of essays and scientific-style articles.

Further didactic characteristics are:

- A large workload and work-pressure ensures creativity and teaches students to deal with deadlines.
- Students are taught to be conscious of the demonstrability of their results.
- Students are stimulated to develop their own scientific curiosity and questioning.
- Students are rather taught the skills of how to master new technologies, than the technologies themselves.

The committee is of the opinion that the didactical approach of learning by doing, within a scientific setting is coherent and congruent to the vision and intended learning outcomes of the Media Technology programme.

Staff
All scientific staff members at LIACS contribute to education in the different bachelor and master programmes, but certain staff members are explicitly allocated to the different programmes.. For staff members, 40% of their work load is spent on education, according to the critical reflection. For PhD students (excluding external PhD students), a total of 10% of their work load is spent on education.

The committee has established that the master programme in Computer Science is well-staffed, but may need expansion when student numbers grow. The master programme in ICT in Business and Media Technology are close to being understaffed in the opinion of the committee. The committee advises to invest in the quantity of staff for these programmes.

The committee concludes that quality of staff members is good. Students are in general positive about their teachers; they are open, easy to contact and teach well. All staff members are active scientists, have a PhD in Computer Science or a related discipline. In the master programme in ICT in Business over 75% fit to this description; the other 25% are valuable for the programme given their relevant experience in the business world. Nearly all staff members have obtained their BKO, a basic qualification for education.

Programme specific quality assurance
The committee has established that the Education Committee plays a key role in the quality control of education within LIACS. The members of the Education Committee are: three staff members, three bachelor students Computer Science, three master students, preferably one from Computer Science, one from Media Technology, one from ICT in Business. The committee is of the opinion that the Education Committee is too big to function effectively and the teacher /student ratio is insufficient. It suggests to make a separate education committee for the bachelor programme, and one for the three master programmes. This would also create a better balance in student and staff members in the committee.

The committee talked to members of Education Committee and concludes that it meets eight times a year, on a fixed year scheme. It advises the Education Director, and it can take initiatives regarding educational issues of all kinds. The Education Committee mainly discusses course evaluations. At the end of each semester written anonymous evaluation questionnaires for all courses are taken and discussed. The Education Committee distributes the results of these evaluation among the lecturers. The Education Committee has plans to organize oral evaluations for the different cohorts similar to the existing ones in the bachelor). The Education Committee, together with the Program Director, makes a yearly report. The report follows a standard university format and summarizes facts and figures, an

analysis of the trends observed (e.g., enrolment, success rates) and a summary of the measures implemented in the academic year, as well as conclusions and resulting action items for the future. At the end of the year the Education Committee also appoints the 'best teacher of the year'. The interview with the Education Committee gave the impression student members are very satisfied and do not feel the need to point out negatives. The committee suggests that the Education Committee can also focus on improving strong points for the future, in a proactive manner. Overall, the committee believes the Education Committee functions properly and it contributes to the quality of the education programmes.

According to the critical reflection, next to the Education committee a Curriculum commission exists temporarily when changes are to be made in the curricula. They meet and work on the curriculum when needed or called for by the Education Director. According to the critical reflection the curriculum committee is asked to review of curriculum components and their contents, based on the electronic study guide and course web sites, to offer suggestions for improvements and togive feedback to the Program Directors and Education Director. The Curriculum Commission therefore serves as an additional quality control board within LIACS, in the event (major) changes are made to the curriculum.

The committee believes it is positive that specific attention is given to curriculum changes. The committee was somewhat surprised to learn that the Educational Committee was not fully aware of the Curriculum Commissions existence, as the members of the Educational Committee did not mention the Curriculum Commission, when asked about curriculum changes. This can be explained by the fact that the Curriculum Commission had not been active recently. It can also be explained by the fact that Curriculum Commission reports to the program directors and education director and not to the Education Committee. The committee believes that changes in the curriculum should be discussed in the Education Committee. The committee strongly advises to clarify the responsibilities and position of the Education Committee, the programme director and any ad hoc commissions. The committee suggests that whenever specific expertise on the curriculum is needed, the Education Committee is invited to contribute to the discussions in the curriculum committee. The curriculum committee reports to the programme director, who will consult with the Education Committee before deciding.

The committee concludes that all programmes have taken the suggestions for improvements, made in the last visitation, serious and improvements have been made.

Student intake and enrolment

For the master programmes in LIACS, the general trend in the enrolment time period 2003–2012 shows growth. This is in line with the intake goals of the programme. Especially in the master programme ICT in Business, due to the successful start of the post experience programme. The enrolment numbers for the specializations within the Master Computer Science differ greatly. Only a very small number of students decide for the Science Based Business specialization and the Science Communications & Society specialization. The majority of students choos the Computer Science specialization. According to the critical reflection their choices reflect their strong interest in the corresponding research areas offered by LIACS, and it shows that students do not see themselves primarily engaging in business or science communication.

The admission procedure has been digitalized and the final decision on admission is delegated to LIACS. The admission procedure now takes days instead of weeks. A positive advice is usually given when the applicant's bachelor diploma is highly comparable to a Dutch bachelor

Computer Science diploma. Students that have the Dutch nationality, students that have obtained a Dutch bachelor diploma and those from native English speaking countries are exempted from an English language test (TOEFL or IELTS). The minimum requirements for the English test are 88 for TOEFL and 6.5 for IELTS. Conditional admission is issued for those students that have not yet obtained their bachelor diploma and/ or do not have a high enough test result for English. The committee agrees with the admission procdures and believes that the digitalized procedure is an improvement, as it takes less time to finish the admission procedure.

There is no specific programme designed for HBO student intake, but, to the committee's surprise this does not lead to any problems. The students the committee talked to indicated that it requires hard work and dedication but is can be done. Lecturers will offer extra help individually to students when asked for.

For the master programme Media Technology, students are invited to an information session; they are asked to submit a curriculum vitae and statement of motivation, and they are invited to an admission interview. Admission into the Media Technology program is open to applicants from diverse bachelor programmes; students, however, have todemonstrate substantive affinity or experience with natural sciences. The committee concludes there are no problems with the admission procedure.

Contact hours and study load
For all three master programmes, the number of contact hours varies per week and per programme. The first year, most time is spent on lectures, while the second year evolved around the research project.

The master programme Computer Science courses typically consists of at least two or three hours of lecture, often accompanied by additional practical exercise groups every week. With about 5 courses a week, this results in an average 15 hours of contact hours per week. The master programme ICT in Business also has an average of 15 contact hours a week. The master programme in Media Technology shows the biggest variation in contact hours per week. Courses typically consist of 2-3 lecture hours per week, but some courses, for example the course Meta Media has a short but intensive programme, with 30 hours of lecture a week and an additional project. In general, students are satisfied with the number of contact hours.

Especially during the second year, students are integrated within the research groups at LIACS for the master programmes in Computer Science and ICT in Business, which guarantees frequent contacts between students and staff. Although students in the master programme Media Technology are not integrated in a research group, they do have frequent contact with the staff, for their own research project.

According to the students the committee talked to during the site visit, study load is not an issue, though the programme in Media Technology is experienced as intensive.

Student support
In the master programmes Computer Science and ICT in Business, choices for elective courses are made by the individual students, and they can ask for help from study advisor. When it comes to the research project and master thesis in the second year, the master class supervisor offers guidance to the students. The support is highly individualized and focuses on individual issues as well as planning matters. According to the study advisor, students know that they can always approach either the study advisor or the master class supervisor in

case of individual issues they need help on. The critical reflection on the master programme Media Technology reports that the program coordinator is the primary point of contact for students. The program coordinator has the explicit task of supporting student processes and she/he acts pro-actively if situations so require. The Media Technology program attempts to create an informal atmosphere in which the distance between student and staff is small, so that students are not discouraged to address particular lecturers for support and advice. In the case of complaints, or issues about the curriculum, students are first expected to address the three weekly board meeting. The committee believes that for all three programmes sufficient student support is organized. The extra attention for guidance during the research project/master thesis is very valuable.

Programme-specific services
LIACS is a member of the DAS-4 consortium. DAS-4 (The Distributed ASCI Supercomputer 4) is a six-cluster wide-area distributed system designed by the Advanced School for Computing and Imaging (ASCI). The DAS-4 computer is used within the Master Computer Science for student projects and master's thesis research, and provides a powerful environment for parallel computing. During the site visit it was mentioned that the programmes within LIACS require more and different ICT facilities, than other programmes do. The requirements do not always correspond to university ICT policy. Given the specific nature of these programmes, the committee states it is highly relevant for these programme to have access to sufficient ICT facilities. The committee asks the Faculty Board to be sensitive to the specific needs of programmes in Computer Science in ICT facilities. Facilities of the Media Technology program are mostly similar to those elsewhere in the Computer Science institute. Media Technology has a limited number of additional facilities:

- equipment, such as camera's, video projectors and some tools that can be lent by students from the program coordinator;
- license keys for specific software tools, e.g. MaxMSP/Jitter licenses;
- a rudimentary work-space where students can realize projects;
- a dedicated lecture room where Media Technology has precedence over others and where equipment can be kept locked overnight between lectures. According to the crucial reflection these facilities are basic and border on insufficient and. The work of students does not suffer, as student think of alternatives, but a dedicated workshop would be much appreciated by students and staff. The committee believes the programme has been creative in organizing specific facilities, and it agrees that a workshop would be an improvement to the education environment.

The committee concludes that overall, programme specific facilities are good.

2.2 Considerations

The committee noticed that for all three master programmes, the vision on education is translated in interesting programmes, with specific didactical characteristics that will support the realisation of the goals formulated under standard 1. Especially for the master programme in Media Technology, the didactical approach of learning by doing, within a scientific setting is coherent, congruent to its vision, and visible in the programme. For the master programmes Computer Science and ICT in Business, the importance of education embedded in research is prominent.

The specialization Science Based Business in the master programme Computer Science has had almost zero enrolment in the past years. In combination with the possible redundancy of

science based business with the master programme ICT in Business, the committee believes that the specialisation in Science Based Business may have lost its relevance. The curriculum of the Communication Science and Society is interesting, but it suffers the same low enrolment numbers as the science Based Business specialization does. Perhaps it could be organised differently, for example as a small cluster of courses on communication science offered (as part of the free choice) in the other Computer Science specialisations.

For all programmes student numbers have increased over the last couple of years, and the programmes aim for/expect more growth in the next couple of years. This will put pressure on the student staff ratio. At the moment, the committee has established that there are no problems for the master programme in Computer Science but the master programmes in ICT in Business and Media Technology are already close to being understaffed in the opinion of the committee. Although the committee has established that it does not lead to problems, the quantity of staff needs attention to maintain the level of quality and student support as is given at the moment in the different master programmes. The quality of staff members is good. According to the committee the programme specific quality assurance is sufficient, but it would benefit from the suggestion made on the size and focus of the educational committee and its role in curriculum changes.

2.3 Conclusion

Master's programme Computer Science: the committee assesses Standard 2 as **satisfactory**.
Master's programme ICT in Business: the committee assesses Standard 2 as **satisfactory**.
Master's programme Media Technology: the committee assesses Standard 2 as **satisfactory**.

Standard 3: Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Explanation:
The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes. The tests and assessments are valid, reliable and transparent to the students.

3.1Findings

This section deals with the assessment system and the level achieved by the graduates of the master's programmes. These subjects will be described in sub sections. In order to establish an opinion about these subjects the committee studied the assessment system and policy of the programme, the test procedures, test regulations, the used test forms and several tests made by students. The committee also had a meeting and discussion with the Board of Examiners responsible for the master's programmes.

The committee studied a selection of master's theses to assess the achieved level of the graduates and had discussions with the students, teachers, alumni and the professional field about the qualifications of the graduates and the relation to the requirements of the labour market.

Assessment system
In all master programmes a variety of examination strategies is used. For the master programmes Computer Science and ICT in Business, overviews of the courses and the examination types show that most courses use multiple types of examination. Written exams with open questions and practical/experimental work are used the most. In the master programme Media Technology a variety of examinations is used, but only in a minor part of the curriculum the written exams is used for examination. For most courses students make a product, a paper, an essay of a verbal presentation as examination. The committee believes the assessment system functions well and the different types of examination are well-chosen to assess knowledge and skills that are required.

The examination committee is responsible for the assessments for all three master programmes (and the bachelor programme) within LIACS. They usually meet every month. The quality assurance procedures for examination and evaluation are the same for the master programmes in Computer sciences, ICT in Business and Media Technology. The Board of Exams (BoE) has set up several quality assurance procedures. An extensive overview is presented in the critical reflection. It addresses the quality assurance procedures and how evaluation takes place for written exams, oral exams for retakes and the master thesis. The BoE also assesses the curriculum for each individual student and approves it before a student is admitted for graduation. The critical reflection of the master programme in Media Technology also states that lecturers often assess students work together, which ensures a shared standard on grading.

The committee agrees with the quality assurance procedures. The committee is of the opinion that the BoE is aware of its role and responsibilities in assuring the quality of assessments. The committee also learned that within the BoE there is a chance of conflict of interest, as two members also have specific responsibilities in the programme. Although arrangements have been made to prevent them of having a vote in specific matters that reflect a possible

conflict of interest, the committee is of the opinion that independence should prevail over programme specific expertise.

Quality and assessment of thesis work
Prior to the site visit, the committee members received 10 recent theses per master programme, selected from a list in the critical reflection of all the theses completed during the last two years. The selection was done by the secretary in consultation with the chairman of the committee. When selecting the theses, the grading and the graduation date, and for the masterprogramme Computer Science the different specializations, were considered. The student numbers of the selected theses are provided in appendix 7. For all theses the committee read the thesis report and when available the evaluation forms.

Master programme Computer Science and Master programme ICT in Business
In the master thesis project, several mechanisms support the assessment of thesis work.

- Students give an oral presentation about the master thesis and they are challenged and assessed on their ability of scientific discussion and critical thinking. Staff members and students can attend the presentation.
- Evaluation forms are being used. The forms are filled out after the defence, and the grade is communicated and explained to the student by the examiner. Designated first and second examiners are indicated in the evaluation form and they sign the form. Any special achievements such as presentations given, papers submitted or published, etc., are evaluated.
- When examiners tend to judge the work (thesis, work & presentation) with a 9.0 or higher, the work should result in at least a peer reviewed conference publication or, preferably, a journal publication. The student should be the first author (or joined first) and have written demonstrably a major part of the publication.

The committee concludes that the theses in Computer Science reflect scientific research at master level. One of the theses in the Bioinformatics specialization showed little computer sciences, but it reflects sound academic work. In one thesis too much jargon was used without explanation, but overall the committee was positive about the topics, the research and the theses. The committee agrees with the grades, although some are a little generous.

The committee also studied theses from the programme ICT in Business and concludes that they show sufficient ICT, and the research is generally well executed. Minor remarks were made about slightly vague research questions. One of the theses in ICT in Business showed very poor English. The committee believes this should have been corrected during the feedback sessions. The other theses shows sufficient use of English, and the committee concludes it is not a fundamental problem. The committee agrees with the grades.

Master programme Media Technology
According to the critical reflection, students finalize their graduation project with a paper that is in principle submittable/publishable. Alternative products of graduation research must be accompanied by such a paper. Students submit a research proposal to the three-weekly board meeting, to approve the proposal and suggest a supervisor, or improvements. The board may request resubmission of the improved proposal before final approval. This happens frequently.

Students present the results of their graduation research project at least once to a public audience. The graduating student must invite two peers or topical experts to be present that have read the graduation paper, and who act as critics during the discussion session following the presentation. The supervisor and several lecturers are present, to discuss the grade. Furthermore, the graduation paper is read by a second lecturer who is consulted by the supervisor concerning the final project grade. Comments on graduation projects and motivation for the final grading are kept in written form.

The committee had difficulties assessing the theses. Students graduate based on a creative work and or a scientific text. Students are evaluated on the process, the creative work and the scientific text. The committee only had the scientific texts to assess. The committee established two problems. First, in several cases the committee felt the scientific text did not reflect the entire research project the student was evaluated on. Although the quality of the projects is indicated by the numerous examples of awards, and the number of published articles based on the projects, the material was not there for the committee to assess it. Installations did no longer exist, photographs were not taken and the settings were not described sufficiently. In some cases a valuable or innovative research process, had not led to impressive results, yet the committee only had the results to assess, and could not assess the development in the process of the research. Secondly, the texts the committee reviewed had raised fundamental questions on the scientific nature of the texts. According to the committees' assessment, the criteria for scientific texts mentioned in the critical reflection of being publishable or admittable were not met. Several reports missed essential parts, such as a research question, a methodological reflection, references to relevant literature and studies, hypotheses and conclusions.

The committee was unable to make a proper assessment on the quality of the thesis in the master programme Media Technology. Essential information regarding the creative work and the process was not available. The scientific text alone did not show sufficient evidence of scientific research according to the committee. During the first site visit this dilemma has been discussed with the lecturers, and the Media Technology programme director extensively. They acknowledged the problems the committee had with the assessments, due to the lack of information on the creative work and the process. Between the first and the second site visit the programme management implemented several measures to mend the problems noticed by the committee.

The committee asked for documentation on the research process, and the creative work, to be able to assess the students work in total. For the first visit this information was not available to the extent that the committee could assess it. This was improved during the second visit: additional information was made available for a substantial number of theses from recent years. The programme director did provide the committee with other recent theses. The committee reviewed and discussed them, both internally in the committee, as with the programme director. Based on the overview of all theses, the committee suspected that the research quality of the students is very good, the topics and research approaches are interesting and sometimes innovative. The committee has seen some very good theses and agrees with the programme management that the master programme stimulates the good students to do innovative and creative research. In the theses of the good students the success of this unique programme can clearly be identified. The committee, however, also saw graduation theses, that didn't show that the students had achieved the level that is expected for a master's degree. It concluded on basis of the studied theses that it can not be guaranteed that all students have achieved the final qualifications.

The committee has pointed out several essential improvements and suggestions for the assessment system of master theses. They have been discussed with the programme director, who acknowledged both the committees assessments and recommendations. These recommendations already resulted in improvement measures after the first site visit. The committee could, however, due to the short period between the first and the second visit, only assess master's theses that were established before the implementation of the new graduation procedure. The committee is confident that the implemented procedure will, in particular, have positive results for the students who need more guidance and structure by developing a research proposal for their graduation thesis. The committee has seen that the programme already started with implementing an improvement plan.

Success rates/performances of graduates

Master programme Computer Science
According to the critical reflection students are very successful in finding suitable jobs after their study, both in PhD positions and at (small) software companies and big companies.
An overview of success rates in appendix 5 show that on average 69% of the students graduate within three years. The dropout percentages are consistently at zero, based on the number of students still registered on February 1 of the academic year – which means that the students who decide to continue after six months all complete their studies. The committee believes these success rates are good.

Master programme ICT in Business
According to the critical reflection students find jobs for major IT consultancies and IT services companies, and IT related jobs in the financial sector, professional services or telecom. Only a few students chose a PhD position. Students are very successful in finding a suitable job after graduation.
An overview of success rates in appendix 5 show that the majority of students have completed their study within three years. The committee believes these success rates are sufficient but they should improve. The programme has planned several improvement measures to increase success rates. Dropout is minimal and is usually explained by a few students who have either financial problems and/or accept a job that doesn't require a master's degree.

Master programme Media Technology
According to the critical reflection students usually find a job after graduation, in scientific research, teaching at HBO institutions, and creative industry. The examples showcased in the critical reflection show remarkable and impressive career paths of alumni. About a quarter of the alumni proceed with a PhD trajectory at several renown universities and research institutions in the Netherlands and abroad.
An overview of success rates in appendix 5 show that about half of the students graduate within three years. Several actions have been taken to improve the success rates. Dropout is minimal and is usually explained by a few students who have either financial problems and/or accept a job that doesn't require a master's degree. The committee believes these success rates are sufficient but they should improve.

3.2 Considerations

The committee believes the assessment system is well organized, for all three master programmes. The committee is of the opinion that the BoE is aware of its role and

responsibilities in assuring the quality of assessments, but the composition of the BoE raised questions on its independence and this should be solved.

The success rates for the master programme in computer science are good, the master programmes in ICT in Business and Media Technology are sufficient but could improve. For both programmes specific measure are taken to improve the success rates. Dropout is minimal to zero, which is very good. For the master programmes in ICT in Business the committee was also positive about the quality of theses and the assessment of the theses.

The committee was unable to make a proper assessment on the quality of the theses in the master programme Media Technology. Essential information regarding the creative work and the process was not available. The scientific text alone did not show sufficient evidence of scientific research according to the committee. The texts the committee reviewed had raised fundamental questions on the scientific nature of the texts. According to the committees' assessment, the criteria for scientific texts mentioned in the critical reflection of being publishable or admittable were not met.

During the first site visit these issues have been discussed intensively with the lecturers in Media Technology. The committee has recommended three essential improvements for the assessment system of master theses:

1. Documentation of the entire project needs to be accurately and guidelines for documentation of the entire project should be specified beforehand.
2. All theses should reflect the scientific character of the master programme. This requires a clear defined problem statement, a scientific methodology and research based conclusions.
3. Students should keep a diary to document their progress on their research project. This diary should be appended to the thesis and is part of the final assessment.

The committee has also formulated three recommendations that will further improve the quality of the thesis and its assessments.

1. The committee suggest to add an external expert on the subject matter, to assess the entire research project.
2. The committee also suggest to plan the start of the final project earlier in the academic year. This has two benefits. First of all students will be able to select their free choice courses more in line with their research project. Secondly, the programme will be able to assess the whether the student has started a feasible research project.
3. A third recommendation is directed to the faculty and concerns the quantity of the staff. As stated under standard 2 the committee is very positive about the quality of the staff and the programme itself, but according to the committee, it requires investment in long-term solutions to the quantity of staff.

Immediately after the first site visit the programme management started with implementation of improvement measures. The committee established during the second site visit that five of the six recommendations mentioned have already been implemented as of January 2014.

- guidelines for documentation of the entire project have been implemented (recommendation 1).
- students keep a diary to document their progress on their research project (recommendation 3).

- the programme changed the rules in the graduation procedure concerning the involvement of 'peers' . One peer has to be external and peers should earlier be involved in the supervision of the graduation project (recommendation 4).
- the start of the final project is shifted from January to Autumn (recommendation 5.).
- the staff will be extended with an UHD, a vacancy has already been published (recommendation 6.).

The programme management met the second recommendation: 'all theses should reflect the scientific character of the master's programme', by implementation of clearly defined graduation procedures and a new graduation form. The committee is convinced that these measures will lead to the desired improvement, but could not yet verify this with finished theses. The committee, therefore has to assess the Master programme Media Technology as unsatisfactory for standard 3, although it wants to stress that the committee considers the Master programme Media Technology as a valuable programme that is unique in the Dutch academic community.

3.3 Conclusion

Master's programme Computer Science: the committee assesses Standard 3 as **satisfactory**.
Master's programme ICT in Business: the committee assesses Standard 3 as **satisfactory**.
Master's programme Media Technology: the committee assesses Standard 3 as **unsatisfactory**.

General conclusion

The committee agrees with the vision and objectives of all three master programmes. The curricula are well-designed and the scientific learning environment makes it possible for students to achieve the intended learning outcomes. The committee has concluded that students in the master's programmes Computer Science and ICT in Business realise the intended learning outcomes. The committee could not, as yet, conclude the same for the master's programme in Media Technology. The committee is confident that the measures taken by the programme will lead to improvement within a short period of time. Because standard 3 is assessed as unsatisfactory at this moment, the NVAO assessment procedures require to assess the entire programme as unsatisfactory, even with the positive assessment of standard 1 (good) and 2 (satisfactory). The master programmes in Computer Science and ICT in Business are both assessed as satisfactory.

Conclusion

The committee assesses the *master's programme Computer Science* as **satisfactory**.
The committee assesses the *master's programme ICT in Business* as **satisfactory**.
The committee assesses the *master's programme Media Technology* as **unsatisfactory**.

Appendices

Appendix 1: Curricula vitae of the members of the assessment committee

Prof. dr. em. Jan Paredaens was a professor at the University of Antwerp and is now dean of the Faculty of Design Sciences at the same university. He graduated as a mathematician from the Free University of Brussels and was awarded his doctorate in 1974 from the Free University of Brussels. He worked until 1979 in the research centre of the company MBLE in Brussels. In 1979 he was appointed lecturer in Informatics at the University of Antwerp. He filled various positions, including Dean of the Sciences Faculty. He has already been a member of the Informatics review committee in the Netherlands. His scientific specialisation is 'Databases and Data mining', on which he has published over 100 international scientific articles. He has also organised a number of international conferences in his subject and is a member of the 'Executive Committee of PODS' in the USA. He was member/chair of numerous Belgian and international committees and panels.

Prof. dr. Lex Bijlsma is professor Education and Softwareconstruction and Vice-Dean of the Faculty of Management, Science and Technology, Open University. He graduated in mathematics in 1973 at the University of Amsterdam and did a PhD on theory of numbers at the same university in 1978. Thanks to a ZW grant he could do research at the *Institut des Hautes Etudes Scientifiques in Bures-sur-Yvette* in 1978-79. In 1979 he became assistant professor at the Eindhoven University of Technology and specialised in computer science. In 1999 Bijlsma was appointed associate professor at Utrecht University, in 2000 director of education computer science and in 2011 also director of education in informatics. In 2007 he was appointed full professor at the Open University. His interest concerns programming methodology, mathematical methods in computer science and software-architecture.

Prof. dr. ir. Bart Preneel is professor at the Department Electrical Engineering-ESAT of the KU Leuven. He received his PhD in 1993 at the KU Leuven in the area of cryptology. He is head of the research group COSIC that foscuses on cryptology, information security and privacy. He was research fellow at UC Berkeley, guest lecturer at 5 universities and academic advisor of Philips. He is president of the IACR (International Association for Cryptologic Research) and member of the Permanent Stakeholders group of ENISA (European Network and Information Security Agency). He participated in several scientific committees, among which: ERC, EPSRC, FNRS, NSF, NWO and STWW**.**

Prof. dr. Sape Mullender is director of Network Systems in Alcatel-Lucent's Bell Laboratories and associate professor of informatics at the University of Twente. He has conducted research in the field of operating systems, multimedia systems, wireless systems and now works on the integration of data processing, communication and storage. He was a founder of the Amoeba distributed system, collaborated on the Nemesis multimedia operating system, Plan 9 from Bell Labs and Inferno. He was awarded his doctorate from the Free University in Amsterdam and worked there as scientific staff member until 1983. From 1984 to 1990 he was head of the distributed systems and computer networks research group at the Centre for Mathematics and Informatics (CWI) in Amsterdam. From 1991 to 1998 he was full professor in Twente; now he is an associate professor there. From 1992 to 1997 he was the world's most northerly located professor of Informatics at the University of Tromsø in Norwegen. In 1998 he began working in Bell Labs. Sape Mullender has published on file systems, high-performance RPC protocols, locating migratable objects in computer networks, and computer security, and has led a series of advanced courses in the field of distributed systems— Arctic'88, Fingerlakes'89, Bologna'90, Karuizawa'91, Lisboa'92, and Redmond'93.

Dr. Caroline Nevejan is Tenured Researcher, with a focus on Participatory systems at the Department of Technology Policy and Management, Delft Technical University. She got her master degree in Communication Science at the University of Amsterdam and her PhD in Social Sciences at the same university. Subject of the dissertation was 'Presence and the Design of Trust'. Her research interest concerns the intersection of media, technology, computer science. Nevejan has been involved with the emerging digital culture since end of the 1980's. She is currently core member of the Netherlands Council for Culture and the Arts.

Peter Boot BSc is master student "Game and Media Technology" at Utrecht University. He did his bachelor's in Computer Science at the same university. He participated in several committees within the university. He was member of the board of the study association A-Eskwadraat in 2011-2012, student member of the Faculty Council of the Science Faculty in 2012-2013 and board member of the Bètadag Foundation.

Appendix 2: Domain-specific framework of reference

1. Domain-specific frame of reference for Master's courses in Computer Science

1.1 Learning outcomes in general
Students to whom a master's degree is awarded:

- Have demonstrated knowledge and understanding that is founded upon and extends and/or enhances that typically associated with Bachelor's level, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research[1] context;
- Can apply their knowledge and understanding, and problem solving abilities in new or
- unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study; Have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements;
- Can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously; have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

1.2 Domain specific contents, the nature of Master degree courses
The Master's degree course will build upon knowledge and understanding at undergraduate level. The core of this knowledge and understanding is as described by the Joint Task Force for Computing Science Curricula of ACM/IEEE-CS in their (draft) report "Computing Science Curricula 2013" (http://cs2013.org/). The contents of the Master's programme should lead the student towards the frontiers of design and applications in the field, and/or towards the major research issues in the field.

The students in the Master's degree course will generally concentrate on subjects in a limited Specialisation within the field, or in the border region with adjacent fields. If the course borders on adjacent fields (Management Sciences, Electrical Engineering and Telecommunication, Cognitive Science, …) it will meet international standards which are not necessarily only the standards set for Computing Science Curricula. In particular such courses have identified a (international) community of courses of a similar nature and they will fit the standards of that community.

The Master's degree course may not aim at educating students to be researchers, or it may have tracks for students who do not aim at such a goal. There is however always a strong relationship between the degree course and research activities, and researchers are active as lecturers and supervisors in the degree course. Even if a student who is awarded the degree is not trained to be a researcher, he will have a basic understanding of the nature of research, and he will have proven research skills.

In each degree course there will be a final project that takes at least one quarter of the entire course. In the final project the student can show his capabilities in each of the five fields of

[1] The term 'research' is used to cover a wide variety of activities, with the context often related to a field of study.
The term is used here to represent a careful study or investigation based on a systematic understanding and critical awareness of knowledge.

the Dublin descriptors (knowledge and understanding, application of knowledge and understanding, forming judgments, communication and learning skills).

1.3 Preparation for a further career in a PhD position or as a highly qualified professional in the field
A talented and successful student in the Master degree course must be educated to a level where he is eligible for a PhD-position. Participation in research projects, especially during the final project must be open to such students.

The Master's degree course must address the development of skills and competencies that are essential for a working professional. It must be possible for students to participate in cooper-nation with trade and industry, in particular during a final project. This requires the courses to have sufficient contacts within trade and industry.

2. Comparison of 3TU academic criteria by Meijers at al. (2005) and the Domain Specific Frame of Reference for Computer Science (Version dated 14 Nov 2012).

3TU academic criteria	Domain Specific Frame of Reference
Competency in one or more scientific disciplines	Demonstrates knowledge and understanding that is founded upon and extends and/or enhances that typically associated with the Bachelor's degree level and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context
Competency in conducting research	Can apply knowledge, understanding and problem-solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the specific field of study
Competency in designing	Can apply knowledge, understanding and problem-solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the specific field of study
Scientific approach	See competency in research and designing
Competency in cooperation and communication	Can communicate conclusions, as well as the underlying knowledge and rationale, clearly and unambiguously to specialised and non-specialised audiences
Basic intellectual skills	Has the learning skills needed in order to continue to study in a manner that is largely self-directed or autonomous
Consideration of the temporal and the social context	Has the ability to integrate knowledge, handle complexity and formulate judgements with incomplete or limited information, while reflecting on social and ethical responsibilities associated with the application of knowledge and judgements

Appendix 3: Intended learning outcomes

Objectives of the Programmes

To impart sufficient knowledge, understanding and skills as to enable the graduate to contribute independently, at an academic level and in an original manner to recognizing, coming up with and solving issues in an area of the natural sciences, to discuss this contribution with colleagues, to inform non-specialists in a clear and unambiguous manner on conclusions and considerations that form the foundation of the study, and to successfully follow a PhD programme within the discipline and its marginal areas.

Achievement Level of the Programmes

The following achievement levels apply with regards to the programmes:

- theoretical and/or practical skills in more than one specialist area of the discipline such that (s)he can carry out research under overall supervision;
- 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;
- the ability to interrelate and integrate various areas of the discipline;
- 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 his/her research results as a contribution to a congress or as (part of) a scientific publication;
- sufficient understanding of the social role of the natural sciences to be able to reflect upon them and in part consequently to come to an ethically sound attitude and corresponding execution of one's professional duties.

Additional competences and learning outcomes specific to the Master's programmes

Computer Science

- Graduates have acquired specific knowledge and theoretical as well as practical skills in at least one of the following three areas of computer science, reflected by the course and project offer:
    - Intelligent algorithms;
    - Multimedia and bioinformatics;
    - Embedded computer systems.

- Graduates have acquired knowledge and skills in applying the algorithms and techniques learned for developing algorithms and software systems to solve problems of practical relevance for science and society.

The bioinformatics specialization aims at the following competencies:

- Graduates have acquired specific knowledge of the disciplines that are important for bioinformatics: computer science, mathematics (including statistics), and molecular biology;

- graduates have proved that they can apply this knowledge to different bioinformatics (research) problems.

Taking into account a shorter research training period for the Master specialisations Science Based Business and Science Communication & Society, the following achievement levels apply:

Computer Science and Science Based Business specialisation:

- sufficient basic knowledge and understanding of strategic and marketing management, financial management, project management, organizational science, patents and quality management;
- experience in setting up and carrying out organizational research within a company, in connection with the research specialization.

Computer Science and Science Communication & Society specialisation:

- knowledge and understanding of modern information and communication technology;
- experience in science communication;
- knowledge of ethical, historical and social aspects in the area of the natural sciences.

ICT in Business

- Graduates have acquired sufficient basic knowledge and understanding of strategic, marketing, financial and project management as well as organizational science to operate effectively on the Business – IT interface.
- Graduates have acquired specific knowledge and theoretical as well as practical skills that enable them:

    - to align the IT function of a firm with the business functions
    - to design, build, implement and maintain applications in a business environment
    - to innovate business, to develop business plans or to transform business based on IT

Media Technology
Upon graduating, students:

- are capable of functioning autonomously within an academic and or research environment, with particular knowledge of the possibilities that information technologies can play in the research process;
- have aptitude in all phases of the traditional 'research chain', i.e. forming research questions, choosing appropriate methods, and communicating research output;
- realize the value of creative thought within the scientific process, and have been exposed to various manifestations of creative science;
- are ready to function at the PhD entry level;
- or typically find their way in the creative industry.

Appendix 4: Overview of the curricula

Global Programme Overview for all specialisations

Smart Computing for Science and Society				
Computer Science Theory & Advanced Technologies	**Core Computer Science**	**Bioinformatics**	**Science Based Business**	**Science Communication & Society**
Choice of courses (60EC) or Choice of courses (42EC) and software project/project study (18EC)	Choice of courses (60EC) or Choice of courses (42EC) and software project/project study (18EC)	Core program (24EC) Methodology of science and engineering (4EC) Choice of specialization courses (20EC) Support program (12EC)	SBB Fundamentals and/or RBB Foundation courses (15-30 EC) Advancement courses (3-20 EC) Training period (Internship/Assignment) (22-35 EC)	Fundamentals of SCS (17EC) Training period (23-34EC) Choice of courses and/or communication master's thesis (subject to individual choice and approval)
Research project (18EC) Master's thesis project (42EC)	Research project (18EC) Master's thesis project (42EC)	Research project (15EC) Master's thesis project (45EC)	Choice of courses related to thesis topic (20EC) Master's thesis project (40EC)	Choice of courses related to thesis topic (20EC) Master's thesis project (40EC)

Specific Programme Content of the specializations 'Computer science theory and advanced technology' and 'Core computer science'.

Course	Lecturer	Level	EC	Year
Advances in Data Mining	Dr. W. Kowalczyk	500	6	1
Bayesian Networks	Prof. Dr. P. Lucas	500	6	1
Databases and Data Mining	Dr. E. Bakker	500	6	1
Evolutionary Algorithms	Prof. Dr. T. Bäck	500	6	1
Multicriteria Optimization and Decision Analysis	Dr. M. Emmerich	500	6	1
Neural Networks	Dr. W. Kowalczyk	500	6	1
Quantum Computing	Dr. A. Deutz	500	6	1
Seminar: Combinatorial Algorithms	Dr. W. Kosters, Dr. H. J. Hoogeboom	500	6	1
Seminar: Distributed Data Mining	Dr. W. Kowalczyk	500	6	1
Seminar: Swarm-based Computation with Applications in Bioinformatics	Prof. Dr. T. Bäck	500	6	1
Audio Processing and Indexing	Dr. E. Bakker	500	6	1
Bio-modeling and Petri Nets	Dr. H. Kleijn, Dr. F. Verbeek	500	6	1
Computational Molecular Biology	Dr. E. Bakker	500	6	1
Mathematical Biology, 'Metabolic Network Analysis'	Dr. S. Hille (Mathematics)	500	6	1
Microscopy, Modeling and Visualisation [a]	Dr. F. Verbeek, Dr. N. Huijsmans	500	7	1
Multimedia Information Retrieval	Dr. M. Lew	500	6	1
Multimedia Systems	Dr. M. Lew, Dr. E. Bakker	500	6	1
String, Pattern, and Motif Search Algorithms	Dr. N. Pisanti [b]	500	6	1
Advanced Compilers and Architectures	Prof. Dr. H. Wijshoff, Dr. E. Bakker	500	6	1
Coordination and Component Composition	Prof. Dr. F. Arbab	500	6	1
Embedded Systems and Software	Dr. T. Stefanov	500	6	1
Testing Object-Oriented Software	Prof. Dr. F. de Boer, Dr. M. Bonsangue	500	6	1
System Development & Project Management	Prof. Dr. T. Bäck	500	6	1
Software Project [c]/Project Study	Individual supervisors	500	18	1
Master Class [d]	Prof. Dr. T. Bäck	600	0	2
Research Project	Individual supervisors	600	18	2
Master Thesis Research Project [e]	Individual supervisors	600	42	2

a. This course has 7 EC since it is also part of the bioinformatics curriculum. Computer science specialization students can attend it and will also receive 7 EC for it.
b. In 2012/13, Nadia Pisanti is a guest lecturer at LIACS.
c. Optional component.
d. The master class is mandatory but has not extra EC. Instead, one EC of the master thesis reflects the master class effort.
e. Determines the specialization: A thesis in the research groups 'Algorithms', 'Foundations of Software Technology' or 'Technology and Innovation Management' implies a specialization in Computer Science Theory and Advanced Technologies. A thesis in the research groups 'Computer Systems' or 'Imagery and Media' implies a specialization in Core Computer Technologies.

Specific content of the bioinformatics specialization

Course	Lecturer(s)		Level	EC	Year
Mathematical Biology, Metabolic Network Analysis	Dr. S.C. Hille	Spec. course	500	6	1
Databases and Data Mining	Dr. E.M. Bakker	Core program	500	6	1
Computational Molecular Biology	Dr. E.M. Bakker	Core program	500	6	1
Microscopy, Modeling and Visualization	Dr. F. Verbeek, Dr. D.P. Huijsmans	Spec. course	500	7	1
Swarm-based Computation with Applications in Bioinformatics	Prof. Dr. T. Bäck, Dr. R. Li	Spec. course	500	6	1
Multimedia Information Retrieval	Dr. M.S. Lew	Spec. course	500	3+3	1
Tutor Molecular Genetics	Dr. H. Linthorst	Support program	500	10	1
Tutor Statistics (for Bioinformatics)	Dr. E.M. Bakker	Support program	500	10	1
Tutor Computer Science (for Bioinformatics)	Dr. E.M. Bakker	Support program	500	2-10	1
Courses at TU Delft					
Pattern Recognition (TUD)	Dr. D.M.J. Tax	Core program	500	6	1
Functional Genomics and Systems Biology (TUD)	Prof.Dr.ir. M.J.T. Reinders, Dr.ir. D. de Ridder	Core program	500	6	1
Methodology of Science and Engineering (TUD)	Dr. M.P.M. Franssen	Methodology	500	4	1
Advanced Bioinformatics (TUD)	Dr. D. de Ridder	Spec. course	500	4	1
Advanced Digital Image Processing (TUD)	Dr. E.A. Hendriks	Spec. course	500	6	1
Medical Visualization (TUD)	Dr. C.P. Botha		500	5	1
2nd year, UL or TUD					
Research Project (TUD or UL)	Individual supervisors		600	15-17	2

Specific programme content of the SBB specialization

SBB Courses	Lecturer	Level	EC
Foundation:			
SBB Fundamentals	Dr. H. Jousma; G. H. Degenaars, MSc; Jan Kooiman, MSc., J. Goldiamond, BA, MBA	400	15
Research Based Business Opportunities	Dr. H. Jousma	400	5
Research Based Business Ventures	Dr. H. Jousma	400	5
Research Based Business Planning	G.H. Degenaars, MSc	400	5
Advancement:			
RBB New Business Development [a)]	Dr. H. Jousma	500	3
RBB Technology Transfer	Dr. H. Jousma	500	3
SBB Management	G.H. Degenaars, MSc; G. de Gier, Dr. J. Rupert	500	3
Learning from Silicon Valley: Entrepreneurship and New Business Venturing [b)]	Dr. H. Jousma, Dr. V. Scholten (TUD), Dr. W. Hulsing (EUR)	500	10
SBB Essay	Dr. H. Jousma	500	3-7
SBB Elective [c)]	Depending on course chosen	400-600	3-15
Finishing:			
SBB Internship	Company supervisors, Dr. H. Jousma, G.H. Degenaars, MSc	600	22-35
RBB Assignments	Project leaders, company supervisors, Dr. H. Jousma, G.H. Degenaars, MSc	600	22-35

a. When these courses are taken together, tot total amount of credits is reduced to 5 EC.
b. This course is offered in collaboration with Delft University of Technology and Erasmus University Rotterdam, and will only be taught when sufficient participants from all three universities are enrolled.
c. The SBB elective can be any course in or related to business and economics offered by a university, provided that the course is chosen in consultation with the SBB supervisor and is approved by the examination committee as part of the student's master program.

Specific programme content for the SCS specialization

SCS Courses	Lecturer	Level	EC
Mandatory:			
Fundamentals of Science Communication and Society	Prof. Jos van den Broek Dr. Anne Land Dr. Mark Bos Drs. Addie de Moor Invited speakers	400	17
Training period [a)]	Various supervisors	600	23-34
Choice of:			
Courses within the research component of the MSc program		500	0-20
Courses in communication		At least 400	0-8
Communication master's thesis	Various supervisors (see list above)	500/600	5
Communication research project correlated to the master's thesis	Various supervisors (see list above)	500/600	4

a. The training period can be in the field of journalism, museology or new media and includes a written report and an oral presentation.

Programme overview ICT in Business master programme

ICT in Business	ICT in Business For hybrid bachelors, including those from LIACS I&E Bachelor variant	ICT in Business Professional experience
Business Fundamentals (18 EC) ICT and Business (48 EC) Electives (9 EC) Research Focussed (11 EC) Master Thesis research (34 EC)	Business Fundamentals (9 EC) ICT and Business (41 EC) Electives (27 EC) Research Focussed (9 EC) Master's thesis project (34 EC)	Choice of specialization courses (40EC) Specialization courses or Software project or project study (20 EC) Research project (17EC) Master's thesis project (43 EC)

Specific programme content of the 'ordinary' and 'professional experience' variants in ICT in Business

Course	Lecturer	Level	EC
Behavioral Decision Making	Dr. R.M. Verburg	500	3
Business Intelligence	Dr. E. Caron	500	3
Change Management	Dr. S. Foster	500	3
Corporate Finance (ICTiB)	Drs. J. Kooiman, CMA	500	3
Financial Accounting	Drs. J. Kooiman	500	3
CIO Business Simulation	Dr. J. Schilt	500	1
ICT Architectures	Drs. B. Kruiswijk	500	6
ICT Enabled Process Innovation	Dr. L. Tockenbürger	500	3
ICT Strategy and Planning	Dr. H. Le Fever (LIACS)	500	3
Managing Innovation	Prof. Dr. B.R. Katzy (LIACS)	500	3
Managing People	Dr. R.M. Verburg	500	3
Management Science	Prof. Dr. S. Pickl	500	3
Marketing Communications	Prof. Dr. J. Faustino/ G.R. Bootland MBA	500	3
Organising	R.T. Hewins, MBA/MBI	500	3
Process Modelling	Drs. P.M. Kwantes	500	3
Research Methods	Dr. J. Schalken	500	3
Software Engineering (ICTiB)	Dr. L. Groenewegen (LIACS)	500	6
Strategy Formation & Implementation	Dr. H. Le Fever (LIACS)	500	5
System Development & Project Management	Prof. Dr. T. Bäck (LIACS)	500	6
Second Year			
Electives		500	9
Capstone Cases	Dr. H. Le Fever (LIACS)	500	3
Research Seminar	Individual supervisors	600	4
Research Colloquia	Dr. W. Heijstek	600	4
Master Thesis Research Project	Individual supervisors	600	34

Specific programme content for students with a bachelor in Computer Science, specialization I&E

Course	Lecturer	Level	EC
Behavioral Decision Making	Dr. R.M. Verburg	500	3
Change Management	Dr. S. Foster	500	3
Corporate Finance (ICTiB)	Drs. J. Kooiman, CMA	500	3
Financial Accounting	Drs. J. Kooiman	500	3
CIO Business Simulation	Dr. J. Schilt	500	1
ICT Architectures	Drs. B. Kruiswijk	500	6
ICT Enabled Process Innovation	Dr. L. Tockenbürger	500	3
ICT Strategy and Planning	Dr. H. Le Fever (LIACS)	500	3
Managing Innovation	Prof. Dr. B.R. Katzy (LIACS)	500	3
Managing People	Dr. R.M. Verburg	500	3
Management Science	Prof. Dr. S. Pickl	500	3
Process Modelling	Drs. P.M. Kwantes	500	3
Research Methods	Dr. J. Schalken	500	3
Software Engineering (ICTiB)	Dr. L. Groenewegen (LIACS)	500	6
Strategy Formation & Implementation	Dr. H. Le Fever (LIACS)	500	5
System Development & Project Management	Prof. Dr. T. Bäck (LIACS)	500	6
Second Year			
Electives		500	27
Capstone Cases	Dr. H. Le Fever (LIACS)	500	3
Research Project	Individual supervisors	600	18
Master Thesis Research Project	Individual supervisors	600	42

Media technology curriculum

Curriculum component	Credits (EC)	Level
Visit to Ars Electronica	1	400
Cool Science	6	500
Creative Research	4	500
Essentials in Art & Music	2	500
Hardware & Physical Computing	3	400
Human-Computer Interaction	6	500
Image & Vision: Embodied Vision	4	500
Introduction to Programming	4	400
Language & Text	3	500
Meta Media	2	500
New Media & New Technologies	5	500
Perceptualization	2	400
Research Seminar Artificial Intelligence	5	500
Sound, Space & Interaction	4	500
Web Technology	4	400
Elective courses	15	400+
Semester Project	20	500
Graduation Research Project	30	600
Total	**120**	

Appendix 5: Quantitative data regarding the programmes

5.1. Data on the Master's Programme Computer Science

Table 1: Master Computer Science inflow of students

Academic Year	Enrolled (from Bachelor)	Dropout (before Feb 1)	Remaining	Male	Female
2003 /04	13 (0)	0	13	9	4
2004 /05	11 (0)	4	7	3	4
2005 /06	5 (0)	2	3	1	2
2006 /07	13 (2)	2	11	6	5
2007 /08	13 (7)	1	12	9	3
2008 /09	22 (13)	4	18	15	3
2009 /10	15 (8)	1	14	12	2
2010 /11	21 (9)	3	18	17	1
2011 /12	27 (9)	1	26	23	3
2012 /13	25 (10)	0	25	24	1

Table 2: Enrollment by specialisation

Academic Year	Enrolled	Computer Science	Bioinfor-matics	SBB	SCS
2003 /04	13	12	0	1	0
2004 /05	11	8	3	0	0
2005 /06	5	5	0	0	0
2006 /07	13	7	6	0	0
2007 /08	13	12	1	0	0
2008 /09	22	16	5	0	1
2009 /10	15	14	1	0	0
2010 /11	21	15	4	2	0
2011 /12	27	19	8	0	0
2012 /13	25	22	3	0	0

Table 3: Based on the number of students enrolled by Sep. 1, the start of the academic year, the table shows the percentage of students graduating within 2–5 years after enrollment (based on academic years for counting)

Year	Enrolled Sep 1	Enrolled Feb 1	Master after 2 yrs	Master after 3 yrs	Master after 4 yrs	Master after ≥5 yrs
2003	13	13	77%	85%	92%	100%
2004	11	7	45%	45%	55%	64%
2005	5	3	20%	40%	60%	60%
2006	13	11	54%	85%	85%	85%
2007	13	12	62%	85%	92%	92%
2008	22	18	50%	64%	73%	
2009	15	14	53%	80%		
2010	21	18	29%			
Avg			**48.7%**	**69.0%**	**76.1%**	**80.1%**

Table 4: Based on the number of students remaining by Feb. 1 of the year following enrollment, the table shows the percentage of students graduating within 2–5 years after enrollment (based on academic years for counting)

Year	Enrolled Feb 1	Master after 2 yrs	Master after 3 yrs	Master after 4 yrs	Master after ≥5 yrs	Avg study duration
2003	13	77%	85%	92%	100%	2.4 jr
2004	7	71%	71%	86%	100%	2.7 jr
2005	3	33%	67%	100%	100%	3.0 jr
2006	11	64%	100%	100%	100%	2.4 jr
2007	12	67%	92%	100%	100%	2.4 jr
2008	18	61%	78%	89%		
2009	14	57%	86%			
2010	18	33%				
Avg		**58.0%**	**82.6%**	**94.5%**	**100%**	**2.6 jr.**

Teacher-student ratio achieved

Table 5 Student-staff ratio for the Master Computer Science

Category	FTE 2006	FTE education	FTE 2009	FTE education	FTE 2012	FTE education
Full Professor	4.4	1.76	3.2	1.28	3.4	1.36
UHD	4.6	1.84	5.5	2.20	3.4	1.36
UD	6.4	2.58	7.8	3.12	7.2	2.88
Researcher	2.2	0.88	4.9	1.98	4.1	1.64
PostDoc	1.0	0.40	0.0	0.00	0.0	0.00
PhD student	21.2	2.12	26.0	2.60	23.4	2.34
total		9.58		11.19		9.58
Master FTE (40%)		3.83		4.47		3.83
Total number of students enrolled		20		37		62
Student/staff ratio		**5**		**8**		**16**

Average amount of face-to-face instruction per stage of the study programme

Master's programme Computer Science: Courses typically consist of at least two course hours per week, often accompanied by additional practical exercise groups (again, two hours per week). With five courses per semester, this results in an average of 15 (= 10 course hours plus about 5 exercise hours) contact hours per week. In the second year of the master, the integration of students in the research groups and supervision of project and master thesis research as well as the master class guarantee tight and frequent contacts between students and staff.

5.2. Data on the Master's Programme ICT in Business

Table 1 Master ICT in Business inflow by year, including information about the number of dropouts by February 1 of the following year, and about male and female students.

Year	Enrolled	Leaving by Feb 1	Cohort size	Male	Female
2003	33	1	32	26	6
2004	22	0	22	20	2
2005	30	0	30	22	8
2006	29	0	29	23	6
2007	17	0	17	12	5
2008	28	0	28	26	2
2009	19	0	19	13	6
2010	28	0	28	22	6
2011	28	0	28	21	7
2012*	38	0	38	25	13

Table 2 Based on the number of students enrolled by Feb. 1, the table shows the percentage of students finished within 2–5 years after enrollment (based on academic years for counting)

Year	Cohort size	Master after 2 yr	Master after 3 yr	Master after 4 yr	Master after ≥5 yr	Avg study completion
2002	11	36%	82%	91%	100%	2.9 yr
2003	32	63%	81%	84%	91%	2.4 yr
2004	22	41%	77%	86%	95%	2.9 yr
2005	30	40%	70%	80%	83%	2.5 yr
2006	29	41%	62%	69%	76%	2.5 yr
2007	17	41%	65%	71%	76%	2.5 yr
2008	28	39%	71%	79%		
2009	19	32%	74%			
2010	28	25%				

Table 3 Drop out Master ICT in business in percentages

Year	Cohort size	Leaving after 1 yr	Leaving after 2 yr	Leaving after 3 yr	Leaving after ≥4 yr
2002	11	0%	0%	0%	0%
2003	32	0%	3%	0%	3%
2004	22	0%	0%	0%	5%
2005	30	0%	0%	0%	10%
2006	29	0%	7%	7%	3%
2007	17	6%	12%	0%	0%
2008	28	7%	4%	0%	0%
2009	19	11%	0%	0%	
2010	28	0%	4%		

Teacher-student ratio achieved

Table 4 FTE and student-staff ratio for the Master ICT in Business, for the years 2006, 2009, and 2012

Category	FTE 2006	FTE education	FTE 2009	FTE education	FTE 2012	FTE education
Full Professor	0.60	0.24	0.60	0.24	0.60	0.24
UHD	-	-	0.50	0.20	0.50	0.20
UD	-	-	-	-	-	-
Docent/Researcher*	1.95	1.95	1.95	1.95	1.95	1.95
PostDoc	-	-	-	-	-	-
PhD student	-	-	1.00	0.10	2.00	0.20
total		2.19		2.49		2.59
Master FTE (100%)		2.19		2.49		2.59
Total number of students enrolled**		68		55		82
Student/staff ratio		**31**		**22**		**25**

* Including external

Average amount of face-to-face instruction per stage of the study programme

The ICT in Business curriculum consists of four eight-week blocks in the first year, typically with seven weeks of teaching per block, and six to seven courses in each block. Courses have between three and four hours of contact time per week, with an average of 15 contact hours per week, plus the meetings between students and staff related to individual supervision.
In the second year of the Master, the research colloquia, electives, the research seminar and capstone cases are conducted, and in addition the supervision of thesis research. This guarantees tight and frequent contact between students and supervisors.
In the second year of the Master, supervision of thesis research as well as the research colloquia guarantee tight and frequent contacts between students and staff.

5.3. Data on the master's programma Media Technology

Table 1 Media Technology MSc inflow of students by year, including information about the number of dropouts by February 1 in the academic year of entry, and the numbers of male and female students.

Year	Enrolled	Dropout before Feb 1	Remaining	Male	Female
2003	30	0	30	16	14
2004	28	1	27	25	2
2005	20	0	20	13	7
2006	22	0	22	15	7
2007	16	0	16	13	3
2008	23	0	23	18	5
2009	26	1	25	18	7
2010	23	3	20	16	4
2011	21	0	21	15	6
2012	28	2	26	17	9

Table 2 Study success rates (cumulative percentage) and average study duration

Year	Cohort size	MSc in 2 years	MSc in 3 years	MSc in 4 years	MSc in ≥ 5 yrs	Avg. study duration
2002	29	10%	38%	41%	48%	3.1 yr
2003	30	13%	40%	43%	57%	3.1 yr
2004	27	19%	44%	70%	81%	3.4 yr
2005	20	15%	70%	85%	90%	3.1 yr
2006	22	23%	41%	64%	64%	2.6 yr
2007	16	19%	44%	63%	69%	2.7 yr
2008	23	9%	52%	65%		
2009	25	4%	52%			
2010	20	10%				

Table 3 Percentages of students not registering after 1, 2, 3 or more years (not cumulative)

Year	Cohort size	Leaving after 1 year	Leaving after 2 yrs	Leaving after 3 yrs	Leaving after ≥4 yrs
2002	29	21%	7%	10%	14%
2003	30	17%	7%	10%	7%
2004	27	7%	4%	4%	4%
2005	20	0%	10%	0%	0%
2006	22	5%	14%	0%	9%
2007	16	6%	13%	0%	0%
2008	23	13%	4%	0%	0%
2009	25	12%	8%	0%	0%
2010	20	20%	0%		

Teacher-student ratio achieved

The teaching capacity is in total 1.4 FTE for the core lecturers, plus 0.1 FTE for PhD lecturers, plus 0.95 FTE for external lecturers. For a total population of 62 students this yields a student-staff ratio of 25 students per FTE.

Average amount of face-to-face instruction per stage of the study programme

Courses typically consist of 2-3 lecture hours per week, but variations exist. For example, the Meta Media course employs 5 × 6 hours of lectures and supervised workgroups in one single week, plus an additional project – an intense format that is appreciated by students and lecturer. Several other courses employ additional lab-hours, in which students work on assignments in a supervised manner. The Semester Project and graduation research project are both supervised in sessions of a collaborative nature: supervisor and student(s) together discuss the project's state and direction.

Appendix 6: Programme of the site visit

October 7

Time *Room* *Activity*

08:30-10:30 176 Internal meeting of the committee
10:30-11:30 176 Reading additional documentation
11:30-12:30 176 Interview with management
5 minutes introductory presentation by Education Director

Prof. Dr. G. R. de Snoo	NL	Dean of the Faculty of Science
Prof. Dr. J. H. de Winde	NL	Vice Dean and Director of Education of the Faculty of Science
Prof. Dr. T.H.W. Bäck	E	Education Director
Prof. Dr. J.N. Kok	NL	Scientific Director
Dr. H.C.M. Kleijn	NL	Director Bachelor Informatica
Dr. H.T. LeFever	NL	Program Director ICT in Business
Prof. Dr. S. Haring	NL	Education Director Media Technology
Dr. E.M. Bakker	NL	Program Director Bioinformatics
Mrs. M. Hodes	NL	Institute Manager

12:30-13:00 176 Lunch
13:00-14:00 176 Interview with Bachelor students

Michiel Vos		I&E	4th yr
Wilco Verhoef		I&E	3rd yr
Simone Cammel	Also with Studievereniging De Leidsche Flesch	Inf	3rd yr
Boyd Witte		Inf	4th yr
Alexander Leznar		Inf	4th yr
Jennifer Jochems		Inf	3rd yr
Bernard van den Boom		Inf	2nd yr
Arthur van Rooijen		Inf	2nd yr
Sarah Haddou	Also attending Honors College	Inf	2nd yr
Mark van den Bergh	Also studying Mathematics	Inf	2nd yr

14:00-15.00 176 Interview with teachers about the Bachelor programme

Dr. M.M. Bonsangue	NL	Logica	1st yr
		Fundamentele Informatica 2	2nd yr
Dr. H. J. Hoogeboom	NL	Studievaardigheden (I&E)	1st yr
		Challenges in Computer Science	1st yr
		Fundamentele Informatica 1	1st yr
Dr. H.C.M. Kleijn	NL	Theorie van Concurrency	3rd yr
		Bachelorklas	3rd yr
Prof. Dr. J.N. Kok	NL	Studievaardigheden	1st yr
Dr. W.A. Kosters	NL	Programmeermethoden	1st yr
		Kunstmatige Intelligentie	2nd yr
Dr. M. Lew	E	Computer Graphics	3rd yr
		Bachelorklas	3rd yr
Dr. S. Nijssen	NL	Computational Intelligence (I&E)	3rd yr
Dr. D. P. Huijsmans	NL	Datastructuren	2nd yr
		Lineaire Algebra en Beeldverwerking (Inf, I&E)	1st & 2nd yr

15:00-15:15 176 Break
15:15-15:45 176 Interview with Master students Computer Science

Koen van der Blom	NL
Leroy van Delft	NL
Jan Kalmeijer	NL
Bas van Steijn	NL
Hao Wang	E
Mahya Mirtar	E
Jaron Vietor	NL
Frank van Smeden	NL
Dimitrios Palachanis	E

15:45-16:15 176 Interview with Master students ICT in Business

Ran An	E
Andrada Bacaoanu	E
Michail Douramalis	E
Wendy Gunther	NL
Nicko van Kerkvoorden	E
Lucas van der Meer	NL
Tyron Offerman	NL
Christos Siskos	E

16:15-16:45 176 Interview with Master students Media Technology

Bernd Dudzik	E
Jasper Scheffel	NL
Alice Schut	NL
Roy van Rooijen	NL
Robin de Lange	NL
Annika Geurtsen	NL

16:45-17:30 176 Interview with Alumni

Frank Takes	CS	NL
Marijn Swenne	CS	NL
Erwin Marges	ICTiB	NL
Marco Kanis	ICTiB	NL
Gengsi Sun	ICTiB	E
Lieven van Velthoven	MT	NL
Danica van der Mast	MT	NL
Peter Curet	MT	NL

17:30 – 18:00 410 Tour of institute with student demos
Dr. Fons Verbeek
18:00 FooBar Drinks

October 8

Time *Room* *Activity*

08:30-09:00 176 Teachers Master Computer Science

Prof. Dr. F. Arbab	E	Coordination and Component Composition
Prof. Dr. T.H.W. Bäck	E	Evolutionary Algorithms
		Seminar Swarm Based Computing
		Master Class
Dr. E.M. Bakker	NL	Databases and Data Mining
		Audio Processing and Indexing
		Computational Molecular Biology
		Advanced Compilers and Architectures
		Multimedia Systems
Prof. Dr. F.S. de Boer	NL	Testing Object-Oriented Software
Dr. M.T.M. Emmerich	E	Multicriteria Optimization and Decision Analysis
Dr. H. J. Hoogeboom	NL	Seminar Combinatorial Algorithms
Dr. M. Lew	E	Multimedia Information Retrieval
		Multimedia Systems
Dr. F. Verbeek	NL	Microscopy, Modeling and Visualization Biomodeling and Petri Nets

09:00-09:30 176 Teachers Master ICT in Business

Prof. Dr. T.H.W. Bäck	E	Systems Development and Project Management
Dr. H.T. LeFever	NL	Strategy Formation and Implementation
		Capstone Cases
Prof. Dr. B. Katzy	NL	Managing Innovations
Drs. B. Kruiswijk	NL	ICT Architectures
Dr. R.M. Verburg (TUD)	NL	Behavioural Decision Making

09:30-10:00 176 Teachers Master Media Technology

Prof. Dr. S. Haring	NL	Cool Science
		Creative Research
E.F. van der Heide, MMA	NL	Essentials in Art and Music
		Perzeptualization
		Sound, Space and Interaction
Dr. M. Lamers	NL	Creative Research
		Perzeptualization
		Research Seminar Artificial Intelligence
Dr. F. Verbeek	NL	Human Computer Interaction

10:00-10:45 176 Education Committee (Opleidingscommissie)

Dr. W. A. Kosters	NL	Chair
Dr. E. M. Bakker	NL	
Dr. Ir. T. Stefanov	E	
Dr. J.M. de Graaf	NL	Study advisor
Chivany van der Werff	NL	BSc Inf, 2nd yr
Erik Soelaksana	NL	BSc Inf, 3rd yr
Jan Zender	NL	BSc I&E
Tobias Kappe	NL	MSc CS
Matthijs van Drunen	NL	MSc CS
Wouter van den Heuvel	NL	MSc Media Tech
Wendy Gunther	NL	MSc ICTiB
Irene Verstraten	NL	Leidsche Flesch

10:45-11:30 176 Exam Committee (Examencommissie)

Dr. Ir. F.J. Verbeek	NL	Deputy Chair
Prof. Dr. F.S. de Boer	NL	
Dr. M.H. Lamers	NL	
Dr. M.S. Lew	E	
Dr. H. LeFever	NL	

11:30-12:00 176 Open office 'hour'
12:00-13:15 176 Internal meeting committee: preparation of the final interview with management / lunch
13:15-14:15 176 Final interview with management

Prof. Dr. G. R. de Snoo	NL	Dean of the Faculty of Science
Prof. Dr. J. H. de Winde	NL	Vice Dean and Director of Education of the Faculty of Science
Prof. Dr. T.H.W. Bäck	E	Education Director
Prof. Dr. J.N. Kok	NL	Scientific Director
Dr. H.C.M. Kleijn	NL	Director Bachelor Informatica
Dr. H.T. LeFever	NL	Program Director ICT in Business
Prof. Dr. S. Haring	NL	Education Director Media Technology
Dr. E.M. Bakker	NL	Program Director Bioinformatics
Mrs. M. Hodes	NL	Institute Manager

14:15-16:15 176 Internal meeting committee preparing the presentation of the preliminary findings
16:15-16:45 174 Presentation of preliminary findings by the chair of the committee
16:45 FooBar Drinks

Appendix 7: Theses and documents studied by the committee

Prior to the site visit, the committee studied the theses of the students with the following student numbers:

Theses Masterprogramme Computer Science

0206121	0731161	0867780	0522929	0239534
0517062	0611735	0824798	0400785	0886122

Theses Masterprogramme ICT in Business

0656577	0966452	0753742	0940623	0976946
0740292	0705705	0674435	1063383	0872369

Theses master programme Media Technology

0773638	0582867	0846589	0746924	0873160
0967300	0937053	0439258	0774650	0978124

During the site visit, the committee studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):

- Standard / basic books
- Tests, assessment criteria, assessment forms and answers
- Minutes of the Board of Examiners 2011
- Minutes of het Educational committee 2009 – 2011
- Course evaluations

Course dossiers:

Computer Science

- Prof. Dr. Thomas Bäck, Evolutionary Algorithms (1st semester)
- Dr. Erwin Bakker, Computational Molecular Biology (2nd semester)

ICT in Business

- Dr. Hans LeFever, Strategy Formation and Implementation (1st semester)
- Dr. Bas Kruiswijk, ICT Architectures (2nd semester)

Media Technology

- Prof. Dr. S. Haring & Dr. M. Lamers, Creative Research (1st semester)
- A.P.A. de Jong, MSc, Web Technology (2nd semester)

Appendix 8: Declarations of independence

nvao
nederlands-vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM:
Dhr. Jan Paredaens

PRIVÉ ADRES:
K Karellaan 42
B-1982 ELEWIJT

IS ALS DESKUNDIGE (voorzitter) / ~~SECRETARIS~~ GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Informatica

AANGEVRAAGD DOOR DE INSTELLING:

TU Delft; Open Universiteit; Rijksuniversiteit Groningen; TU Eindhoven; Universiteit Utrecht, Radboud Universiteit, Universiteit Leiden; UvA/VU; Universiteit Twente

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

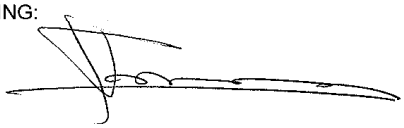
VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Antwerpen

DATUM: 26.4.13

HANDTEKENING:



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ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: A. Bijleveld

PRIVÉ ADRES:

Maasvelderweg 22, 6229 XT Maastricht

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

B Technische Informatica M Computer Science
M Human Media Interaction M Telematics

AANGEVRAAGD DOOR DE INSTELLING:

U Twente

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nederlands - vlaamse accreditatieorganisatie

VERKLAART HIERBIJ ZODANIGE RELATIES OF BANDEN MET DE INSTELLING DE AFGELOPEN VIJF JAAR NIET GEHAD TE HEBBEN;

VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Heerlen DATUM: 9-4-'13

HANDTEKENING:

nvao

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: BART PRENGEL

PRIVÉ ADRES: PRINSES LYDIALAAN 54

B-3001 LEUVEN

BELGIE

IS ALS DESKUNDIGE / ~~SECRETARIS~~ GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

INFORMATICA

AANGEVRAAGD DOOR DE INSTELLING:

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Leiden

DATUM: 25/04/2013

HANDTEKENING:

QU35

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ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Sjaak J. Mullender

PRIVÉ ADRES: Prinsengracht 797
1017 KA Amsterdam

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

B Informatica
M Computer Science

AANGEVRAAGD DOOR DE INSTELLING:

Universiteit Leiden

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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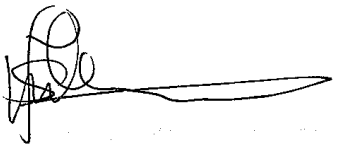
VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: ANTWERPEN DATUM: 4-4-2013

HANDTEKENING: 

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nederlands-vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM:
Dhr. Peter Boot

PRIVÉ ADRES:

Warande 82
3705 ZG Zeist

IS ALS DESKUNDIGE / ~~SECRETARIS~~ GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

Informatica

AANGEVRAAGD DOOR DE INSTELLING:

Rijksuniversiteit Groningen ; TU Eindhoven; Radboud Universiteit ;
Universiteit Leiden; Universiteit Twente

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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nederlands - vlaamse accreditatieorganisatie

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VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS:
Antwerpen

DATUM:
26-4-2013

HANDTEKENING:

Q435

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nederlands-vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Marlous Maarleveld

PRIVÉ ADRES:
BMC - Smallepad 84
3811 MG Amersfoort

IS ALS DESKUNDIGE / SECRETARIS GEVRAAGD VOOR HET BEOORDELEN VAN DE OPLEIDING:

informatica

AANGEVRAAGD DOOR DE INSTELLING:

VU en UvA

VERKLAART HIERBIJ GEEN (FAMILIE)RELATIES OF BANDEN MET BOVENGENOEMDE INSTELLING TE ONDERHOUDEN, ALS PRIVÉPERSOON, ONDERZOEKER / DOCENT, BEROEPSBEOEFENAAR OF ALS ADVISEUR, DIE EEN VOLSTREKT ONAFHANKELIJKE OORDEELSVORMING OVER DE KWALITEIT VAN DE OPLEIDING TEN POSITIEVE OF TEN NEGATIEVE ZOUDEN KUNNEN BEÏNVLOEDEN;

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VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: Utrecht DATUM: 28-6-2013

HANDTEKENING:

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