Informatica OW 2013

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Eindhoven University of Technology

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This report was finalized on **11 December 2013**.

Report on the bachelor's programme Computer Science and Engineering, the master's programme Computer Science and Engineering and the master's programme Business Information Systems of Eindhoven University of Technology

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

Administrative data regarding the programmes

Bachelor's programme Computer Science and Engineering

Name of the programme:	Computer Science and Engineering
CROHO number:	56964
Level of the programme:	bachelor's
Orientation of the programme:	academic
Number of credits:	180 EC
Specializations or tracks:	Software Science Web Science
Location(s):	Eindhoven
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2014

Master's programme Computer Science and Engineering

Name of the programme:	Computer Science and Engineering
CROHO number:	60438
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	Computer Science and Engineering Information Security Technology Service Design and Engineering
Location(s):	Eindhoven
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2014

Master's programme Business Information Systems

Name of the programme:	Business Information Systems
CROHO number:	60432
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	
Location(s):	Eindhoven
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2014

The visit of the assessment committee Informatica OW 2013 to the Department of Mathematics and Computer Science of Eindhoven University of Technology took place on 12-13 September 2013.

Administrative data regarding the institution

Name of the institution:	Eindhoven University of Technology
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	applied (pending)

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 programme Computer Science consisted of:

- Prof.dr. J. Paredaens (chairman), retired professor in Database Research, Antwerp University;
- Prof.dr.ir. B. Preneel (member), professor in Information Security, KU Leuven;
- Prof.dr. S. Mauw (member), professor in Security and Trust of Software Systems, University of Luxembourg;
- Prof.dr.ir. W. Van Petegem (member), associate professor and Director Teaching and Learning, KU Leuven;
- P. Boot Bsc (student member), master student Computer Science, Utrecht University.

The committee was supported by drs. J. van Zwieten MA, who acted as secretary.

The Eindhoven University of Technology board and the Accreditation Organisation of the Netherlands and Flanders (NVAO) agreed to the composition of the assessment committee. Appendix 1 contains the curricula vitae of the members of the committee. All members of the committee and the secretary signed a declaration of independence as required by the NVAO protocol to ensure that they judge without bias, personal preference or personal interest, and the judgement is made without undue influence from the institute, the programme or other stakeholders (see Appendix 8).

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

Working method of the assessment committee

The assessment of the master's programme Computing Science was part of an assessment cluster. In total, the committee assessed 26 programmes from ten universities: Open Universiteit, 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.

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 total of twenty Software engineering Project Reports to assess the level achieved by the bachelor graduates and twenty-five theses for the master's programmes. The reports and theses were randomly chosen from lists 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 the Eindhoven University of Technology. The timetable for the visit in Eindhoven 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.

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 the Eindhoven University of Technology.

Decision rules
In accordance with the NVAO's Assessment framework for limited programme assessments (as of 6 December 2010), 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

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

Bachelor's programme Computer Science and Engineering

Standard 1
The committee concludes that the academic and professional level of the intended learning outcomes of the bachelor's programme are in line with the Domain Specific Framework of Reference and international standards. The necessary competences are clearly represented in the intended learning outcomes of the programme.

The committee is very positive about the clear design-based profile of the bachelor's programme. In the intended learning outcomes the programme formulates clear ambitions on the academic character of the programme, as well as on the intended professional skills.

Standard 2
The curriculum of the bachelor's programme in the Bachelor College, which started in September 2012, is structured in different parts: the major (Software Science or Web Science, 90 EC), Basics (30 EC), USE (User, Society, Enterprise) package (15 EC) and electives (45 EC). The committee has studied the curriculum and concluded that it is designed as a coherent programme that covers the intended learning outcomes of the programme. The design of the curriculum is clear, attractive and structured in coherent packages. Courses have clear learning objectives. The bachelor's programme offers a lot of flexibility to students; they receive good guidance to make the right choices. The committee concludes that there are currently too few students going abroad during their bachelor's programme. Therefore they advise the programme management to stimulate and facilitate international exchange more actively.

The bachelor's programme uses several teaching concepts in order to realize different learning objectives. The committee highly appreciates the Design-Based Learning concepts, where students integrate and apply knowledge from different courses and practise professional skills as well. The committee is impressed by the set up and the results of the final Software Engineering Project.

The study yield of the programme is low. The committee established that the programme has taken several measures to enhance the study duration. The committee is enthusiastic about the facilities that are offered to students. The housing is modern and well equipped. Study guidance is sufficiently available for students. The committee is very pleased with the teaching staff, in both quantitative and qualitative terms. There is a policy in place to promote the teaching skills of the lecturers. The committee is of the opinion that the programme is well organized and that the students are well prepared for obtaining their final qualifications. It is impressed by the way in which the programme is continuously focussing on quality improvement.

Standard 3
The committee confirmed that the assessment system of the programme is adequate. Students are well informed about evaluation criteria and examination procedures. The Board of Examiners and university management have installed different instruments to safeguard assessment quality and graduation level. The committee appreciates the proactive role of the

Borgingscommissie in this process. The committee was very pleased by the wide range of initiatives that the department took in the context of this standard and it appreciated very much the high standard of the assessment of the courses, the projects and the theses. The committee advises to complement the assessment policies with an assessment plan for the programme and a general fraud policy.

To assess the final level realised by the students, the committee examined a range of final projects. It concluded that the final level of the projects was high and matched with what could be expected of a graduate of a bachelor's programme.

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

Master's programme Computer Science and Engineering

Standard 1
The committee concludes that the academic and professional level of intended learning outcomes of the master's programme are in line with the Domain Specific Framework of Reference and international standards. The necessary competences are represented clearly in the intended learning outcomes of the programme. The programme has an appropriate research oriented profile. According to the committee this profile could be aligned more explicitly with the requirement of the professional field. The committee understood that the planned introduction of streams is meant to improve this.

Standard 2
The Computer Science and Engineering master's programme is organized around eight research topics (related to the research groups within the department): Algorithms, Visualization, System architecture and networks, Databases and hypermedia, Security, Software engineering and technology, Architecture of information systems and Formal system analysis. The programme also offers two specialized tracks: Information Security Technology (IST) and Service Design and Engineering (SDE). The curricula of the regular master's programme and the two specialized tracks IST and SDE have the same structure: core courses (25-36 EC), electives (25-60 EC), a research seminar (4-6 EC) and the final project (30 EC).

The committee concludes that the curriculum is coherent and that the students are well prepared for obtaining their final qualifications. There is a close link between research and education. The research seminar, capita selecta and master's thesis enable students to become independent researchers. The course proposition is broad and flexible. The committee observed that as a result of the flexibility of the programme, it is sometimes necessary to bridge gaps in prerequisite knowledge of some of the students. This can interfere with realising an in-depth level.

The study yield of the programme is low. The programme has the ambition to increase the study yield to 90% of the students graduating in 2.5 years. The committee concluded that there is not yet a clear plan on how to realize this ambition. The committee is enthusiastic about the facilities that are offered to students. The housing is modern and well equipped. Study guidance is sufficiently available for students.

The committee is very pleased with the teaching staff, in both quantitative and qualitative terms. There is a policy in place to promote the teaching skills of the lecturers. The committee is of the opinion that the programme is well organized and that the students are well prepared for obtaining their final qualifications. It is impressed by the way in which the programme is continuously focussing on quality improvement.

Standard 3
The committee concluded that the assessment system of the programme is adequate. Students are well informed about evaluation criteria and examination procedures. The Board of Examiners and university management have installed different instruments to safeguard assessment quality and graduation level. The committee appreciates the proactive role of the *Borgingscommissie* in this process. The committee was very pleased by the wide range of initiatives that the department took in the context of this standard and it appreciated very much the high standard of the assessment of the courses, the projects and the theses. The committee advises to complement the assessment policies with an assessment plan for the programme and a general fraud policy.

To assess the final level realised by the students, the committee examined a range of final projects. It concluded that the final level of the projects was high and matched with what could be expected of a graduate of a master's programme.

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

Master's programme Business Information Systems

Standard 1
The committee concludes that the academic and professional level of the intended learning outcomes of the master's programme are in line with the Domain Specific Framework of Reference and international standards. The necessary competences are represented clearly in the intended learning outcomes of the programme. The programme has a relevant profile, combining a technological perspective with a business perspective on computer science.

Standard 2
The curriculum of the master's programme in Business Information Systems consists of core courses (45 EC), specialization streams (15-21 EC), electives (24-30 EC) and a master thesis (30 EC). The core courses aim at covering an adequate knowledge level in business information systems, with courses in computer science (25 EC) and in industrial engineering (20 EC). Students can choose one out of four specialized streams: Business Process Management, Health Care, ICT Services or Logistics. The master's programme Business Information Systems has according to the committee a transparent and coherent programme. It offers four different streams that enable students to follow a coherent package of courses that match their specific interests. According to the committee, the programme offers with these streams a broad opportunity for students to learn about all aspects of Business Information Systems. The curriculum is well in line with the programme's profile. The committee observed that there is a good balance between information based and business based courses. The possibility to do a graduation project externally offers students the opportunity to obtain professional experience during their education.

The study yield of the programme is low. The programme has the ambition to increase the study yield to 90% of the students graduating in 2.5 years. The committee concluded that there is not yet a clear plan on how to realize this ambition. The committee is enthusiastic about the facilities that are offered to students. The housing is modern and well equipped. Study guidance is sufficiently available for students.

The committee is very pleased with the teaching staff, in both quantitative and qualitative terms. There is a policy in place to promote the teaching skills of the lecturers. The committee is of the opinion that the programme is well organized and that the students are well prepared for obtaining their final qualifications. It is impressed by the way in which the programme is continuously focussing on quality improvement.

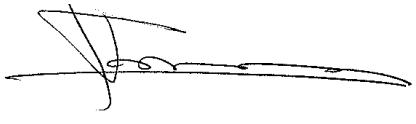
Standard 3
The committee confirmed that the assessment system of the programme is adequate. Students are well informed about evaluation criteria and examination procedures. The Board of Examiners and university management have installed different instruments to safeguard assessment quality and graduation level. The committee appreciates the proactive role of the *Borgingscommissie* in this process. The committee was very pleased by the wide range of initiatives that the department took in the context of this standard and it appreciated very much the high standard of the assessment of the courses, the projects and the theses. The committee advises to complement the assessment policies with an assessment plan for the programme and a general fraud policy.

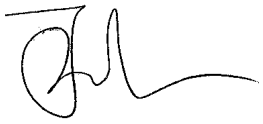
To assess the final level realised by the students, the committee examined a range of final projects. It concluded that the final level of the projects was high and matched with what could be expected of a graduate of a master's programme.

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

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: 11 December 2013





prof.dr. J. Paredaens, voorzitter

drs. J. van Zwieten MA, secretaris

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.

Findings

This standard deals with the profile, orientation and the intended learning outcomes of the bachelor's and master's programme in Computer Science and Engineering and the master's programme in Business Information Systems. These are related to the Domain Specific Reference Framework.

Profile

The committee has learned from the Critical Reflection that the *bachelor's programme Computer Science and Engineering* of Eindhoven University of Technology has several profiling characteristics in relation to the Domain Specific Reference Framework (see: Appendix 2).

First, the programme puts emphasis on academic design skills. Although research is addressed as well, the programme is design-based: it intends to teach students the ability to develop and improve software in a structured manner. The committee is very positive about this profile. Hereby the programme combines the theoretical background with practical skills. The theoretical framework of the programme is based on modelling, which is a logical result of the history of the programme with founders who were specialized in modelling.

Second, the programme has an international profile. Since all courses are taught in English by staff members from different countries, it succeeds in attracting an international student population. Currently, around ten per cent of the intake is international.

Furthermore, the programme offers two majors: *Software Science* and *Web Science*. The latter was established in 2011. With this major, the programme intends to address a current and urgent need for a new labour force skilled in developing new web-based systems and services. The programme attracts a new student population that wants to be part of these developments in computer science. The committee believes that this is a valuable profile with a good market potential.

Finally, as a result of the 2012 introduction of the university-wide Bachelor College, the programme incorporates more generic technical knowledge and skills and addresses the link with users, society and the corporate world. The committee endorses the value of a programme with a broader social perspective, while it also warns that this development might reduce the disciplinary knowledge and in particular the knowledge of mathematics

The *master's programme Computer Science and Engineering* aims at providing students with advanced knowledge and skills and a deeper understanding of a number of areas within computer science. The programme is built around eight research groups and is therefore more research driven than the bachelor's programme. Within the programme, students can choose from a wide range of specialization areas. The programme also offers two specialized tracks: Information Security Technology (IST) and Service Design and Engineering (SDE).

The committee establishes that the research based profile of the programme is conform the Domain Specific Reference Framework (appendix 2). However, this profile is not very distinctive. The committee thinks that organising the programme from the eight research groups is acceptable, but it would be better to explicitly align it with the requirements of the professional field as well.

The *master's programme Business Information Systems* combines a technical perspective with a business perspective on business information systems. It aims at providing students with advanced knowledge and skills needed for the design, analysis and application of these systems. It offers specialization in four application areas: Business Process Management, Health Care, ICT Services and Logistics.

The committee established that this master's programme has, within the Domain Specific Reference Framework (appendix 2), a focus on applications. The combination of a technical and a business perspective offers a clear and relevant profile.

Level and orientation
TU/e derives intended learning outcomes for all programmes from the academic criteria of Meijers et al. (2005), also known as the ACQA criteria. The Critical Reflection Reports contain a comparison of the intended learning outcomes of the three programmes and the ACQA criteria. It shows that every criterium is covered by one or more of the intended learning outcomes of each programme. The academic orientation of the programmes is sufficiently demonstrated according to the committee.

As explained in the following paragraphs, the programmes are based upon the Domain Specific Reference Framework (hereafter: the Framework, appendix 2). This Framework is derived from the (draft) report *Computer Science Curricula 2013* (*Strawman Draft*) of the *Joint Task Force for Computing Curricula* of the co-operating organisations ACM and IEEE-CS. The report *Computer Science Curricula 2010* was updated in 2013.

For *bachelor's programmes* the Framework describes eleven Characteristics of Graduates and eighteen Knowledge Areas. The Characteristics and Knowledge Areas are intended as reference point, rather than a strict norm. Programmes should describe their own position within this Framework.

A comparison of the intended learning outcomes with the Characteristics of the Framework shows that ten of the characteristics are covered by the intended learning outcomes. The characteristic 'Appreciation of domain-specific knowledge', which indicates that graduates should be able to communicate with experts from different domains, is not explicitly covered within the intended learning outcomes of Eindhoven's bachelor's programme. However, the committee established that the design of the Bachelor College provides the students with knowledge in different domains and skills to cooperate in mixed project teams.

Both majors of the programme cover the eighteen knowledge areas of the Framework. The major Software science emphasizes, compared to the Framework, Algorithms and Complexity, Software Engineering, and Information Management. Web Science is more focused on Information Management, Platform-based Development and Computational Science than the reference of the Framework.

The overall objective of the bachelor's programme is to enable students to progress into an appropriate master's programme and/or to embark upon a professional career in the fields of software science or web science. This general objective is translated in intended qualifications regarding:

- Basic knowledge and skills in computer science and engineering
- Software design
- General academic skills

The intended qualifications of the programme are listed in Appendix 3.

The committee studied these qualifications and concludes that they meet the requirements of the Framework. The qualifications describe clearly the intended learning outcomes of the programme and demonstrate the academic orientation of the programme. The committee appreciates the formulated ambitions on combining the academic character of the programme with the development of professional skills.

Both *master's programmes* have the same intended learning outcomes. The programmes aim at offering students more specialized and research-related knowledge and at teaching them to tackle a complex research or design project. This research orientation is in accordance with the Framework for master's programmes. Both specialized tracks of the *Computer Science and Engineering* master (IST and SDE) and the *Business Information Systems* master have additional intended learning outcomes that describe the specific disciplinary qualifications. The intended learning outcomes of the programmes are listed in Appendix 3.

The Framework defines general learning outcomes according to five goals established in the Dublin descriptors. In the Critical Reflection Report these five goals are mapped onto the intended learning outcomes of the master's programmes in Computer Science and Business Information Systems. It shows that the intended learning outcomes cover the generic goals of the Framework and therefore aim at an academic master's level.

Considerations

The committee concludes that the academic and professional level of intended learning outcomes of both the bachelor's programme and the master's programmes are in line with the national Framework and international standards. The necessary competences are represented clearly in the intended learning outcomes of the programmes.

The committee is very positive about the clear design-based profile of the bachelor's programme. In the intended learning outcomes the programme formulates clear ambitions on the academic character of the programme, as well as on the intended professional skills.

The Business and Information Systems master's programme has a relevant profile as well, combining a technological perspective with a business perspective on computer science. The master's programme Computer Science and Engineering has an appropriate research oriented

profile. According to the committee this profile could be aligned more explicitly with the requirement of the professional field.

Conclusion

Bachelor's programme Computer Science and Engineering: the committee assesses Standard 1 as **good**.
Master's programme Computer Science and Engineering: the committee assesses Standard 1 as **satisfactory**.
Master's programme Business Information Systems: the committee assesses Standard 1 as **satisfactory**.

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.

Findings

In this Standard the design and the coherence of the curricula are examined (2.1). Subsequent paragraphs discuss the scientific orientation (2.2), study load, guidance and rates (2.3) and the composition of the academic staff (2.4). Finally, the programme-oriented internal quality assurance, which includes descriptions of the measures for improvement implemented as a result of the previous visit (2.5) are dealt with.

Programme and coherence of the curricula
The curriculum of the *bachelor's programme Computer Science and Engineering* in the Bachelor College is structured in different parts: the major (Software Science or Web Science, 90 EC), Basics (30 EC), USE (User, Society, Enterprise) package (15 EC) and electives (45 EC).

The majors are structured along coherent packages (*leerlijnen)*. Both majors include the following packages:

- Theory and algorithms
- Software development
- Information systems
- System architecture and networks

In addition, the Web Science major includes the packages Web technology and ICT in context. The four common packages are extended for students of the Software Science major.

The Basics courses are university wide introductions in beta sciences, design, humanities & social sciences and professional skills. The humanities & social sciences course prepares students for their USE package by positioning the engineering profession in a societal context. Students can choose one of the ten different USE packages. Each package covers a theme with an exploratory subject, a deepening subject and an applied subject or project. The USE packages are introduced to introduce students to the context of their engineering discipline. The committee appreciates this contextualization of the core courses in the USE packages.

Students can choose their electives from different structured packages (e.g. Interactive intelligent systems, Security or Game design) that are offered in the programme. They can also choose courses from other departments. All elective packages need to be approved by the Board of Examiners, that watches over the coherence of the individual programmes. The committee observed that the electives are spread in time throughout the programme. This makes it difficult for students to integrate an international exchange in their programme. Quantitative data concerning exchange students have shown that there are indeed very little students who go abroad during their education. The committee believes that this is a

weakness of the programme and encourages the programme management to define a more ambitious policy on this matter and to improve practical arrangements with respect to programmes and facilities.

The Bachelor College promotes activating teaching formats. The programme uses a mix of methods, such as lectures, tutorials, assignments, self-study, practicals and Design-Based Learning (DBL) projects. To enhance the interaction during lectures, clickers are used for short quizzes or polls. Together, these teaching forms contribute to the development of the intended knowledge, skills and attitude of the students. The committee studied the learning materials of a selection of courses. Their conclusion is that in general the quality of courses is good, manuals are clear and with interim tests or assignments students are activated along the duration of courses. The committee observed that some of the courses should offer more practical skills. In particular, the course Computer Networks is mainly theoretical. According to the committee this subject should be addressed from a more practical/application perspective as well.

Design-Based Learning is a university wide teaching concept, operationalized in specific projects. In such a DBL project, students work in teams on design assignments. The assignment is set up so that students integrate and apply theoretical knowledge from various courses. Within these projects students enhance their professional skills, such as presentation and communication skills. In both majors of the bachelor's programme a DBL project is scheduled in each year. Students can participate in other DBL projects as well as part of their elective packages.

The DBL project in the third year of the bachelor's programme is the so-called Software Engineering Project (SEP), which is the final project of the programme. The SEP project enables students to work in a supervised setting on a real-life assignment, thereby preparing them for functioning in the professional field. In this project, students work in groups of eight on a large and complex software system or a prototype product for a real-life external customer. The quality of the external assignments is well guarded by the responsible staff. Each group of students has its own project room. Master students function as project manager and quality manager. A staff member is appointed for technical advice and reviewing. At the end of the project, students reflect on the project and on the bachelor phase in their portfolio. This consists of several reflection exercises. The committee highly values the design of the SEP project and the quality of the delivered products.

The committee concludes from the description in the Critical Reflection, the discussions with staff members and students that the curriculum is organized in a clear and coherent manner. While the two majors and the large part of the electives in the programme provide a lot of flexibility for students, the structured packages in the majors and in the electives provide for coherence. The DBL projects form an effective translation of the intended design profile of the programme into the curriculum.

The curricula of the regular *master's programme Computer Science and Engineering* d the two specialized tracks IST and SDE have the same structure: core courses (25-36 EC), electives (25-60EC), a research seminar (4-6 EC) and the final project (30 EC).

The regular programme is organized around eight research topics (related to the research groups within the department):

- Algorithms

- Visualization
- System architecture and networks
- Databases and hypermedia
- Security
- Software engineering technology
- Architecture of information systems
- Formal system analysis

The regular master's programme is very flexible and offers students a lot of freedom to compose their own curriculum. Students choose a core course package from five specializations, thereby getting an overview of a broad spectrum of research fields. Additionally, students choose twelve elective courses, depending on their own preferences. They can consult the contact person of a research group or the study advisor to obtain advice on the composition of their programme. The Critical Reflection mentions that in order to increase the guidance, the programme intends to introduce a coaching system. Each student will have a staff member assigned who acts as a coach to discuss the choices the student will make. The committee welcomes this intention.

Each specialization offers four to seven electives. One of them is the Capita Selecta. Students were very enthusiastic about this course, which offers them the opportunity to perform an individual in depth study on a topic of their interest, with the guidance of a dedicated staff member. Apart from the computer science research groups, students can also choose relevant electives from other departments. There is a list of eighteen electives that are presumed to be suitable for computer science students. Students can also choose to incorporate an internship (15 EC) in their programme.

Students choose one of the research groups for their final project. To graduate in a research group, they need to follow at least two elective courses and the research seminar in that group. Half a year before planning their final project, students consult a staff member of this group to discuss which courses are recommended in order to be well prepared for their final projects. Each individual study programme needs to be approved by the Board of Examinors. During the site visit, the committee studied a selection of individual study programmes. Their conclusion is that the programmes are quite similar and coherent.

During the conversation with students the committee noted that as a result of the flexibility of the programme, groups can be very heterogeneous. Therefore, it is necessary in the beginning of a course, to bridge gaps in prerequisite knowledge of some of the students. At the same time, there is some overlap between courses that build on the same basic knowledge. The committee recommends the programme to manage these problems more effectively. That would also allow to reach a more advanced level in the courses.

The IST programme offers students a specialization in information security technology. It deals with technical, theoretical, legal and ethical aspects of information security. Students obtain tools to enable secure communication and data protection. The core curriculum covers topics such as cryptography, operating systems and verification of security protocols. The programme is organized in cooperation with Radboud University of Nijmegen and the University of Twente in their joint *Kerckhoffs Institute*. The IST core curriculum consists of six courses, two at each of the participating universities. Students have to choose at least three electives from the nine courses that are offered within the *Kerckhoffs Institute*. The committee is positive about the facilities that are available to support this programme at the three different locations, such as web lectures and travel cost reimbursement, but notes that the support and

infrastructure leave some room for improvement (e.g. not all lectures are available remotely) Studying the programme and discussing with the students, the committee concluded that the programme should ensure that all students receive sufficient education on legal and ethical issues related to information security.

The SDE programme is an international programme, organized together with Aalto University, Budapest University and University of Trento, within the framework of the European Institute of Innovation and Technology. The focus of this programme is on the computer science aspects of services. Entrepreneurship and innovation are central themes in this track. Students participate in a minor Innovation & Entrepreneurship and mandatory technical courses. Each student chooses an entry point university (first year) and an exit point university (second year); mobility is a key concept in the SDE programme. Each university offers a different specialization in the exit point program. The focus of the exit programme in Eindhoven is on Service-Oriented Business Process Management. The committee is of the opinion that this is an innovative area with a good potential in the professional field. This exit point programme only started a few weeks before the visit of the committee and hence it was impossible to evaluate it.

A more detailed composition of the four tracks is given in Appendix 3.

The curriculum of the *master's programme in Business Information Systems* has the following structure:

- Core courses (45 EC)
- Specialization streams (15-21 EC)
- Electives (24-30 EC)
- Master thesis (30 EC)

The core courses aim at covering an adequate knowledge level in business information systems, with courses in computer science (25 EC) and in industrial engineering (20 EC).

Students can choose one out of four specialized streams: Business Process Management, Health Care, ICT Services or Logistics. Each stream offers a coherent package of three or four courses. Starting from September 2013, the curriculum is being restructured in a few ways. There are eight instead of nine core courses and all specialized streams consist of four courses. The stream Health Care is discontinued due to lack of interest among students. The other streams are modified and renamed into Logistics, Information Management and Business Process Intelligence.

The stream Logistics combines a managerial and a mathematical perspective on logistical systems. It addresses the topics finance and accounting, supply chain management, constraint-based optimization and distributed systems. Students learn to understand complex logistical systems and to develop solution architectures to optimize these systems.

The stream Information Management offers a management perspective on information technology. It examines how people interact with software, how software should be managed and how innovative organizations should be organized. General business skills as networking and business planning are addressed as well.

The Business Process Intelligence stream covers the technical aspects of business information systems. E.g. students analyse models and other sources of information using techniques and insights from meta-modelling, process mining, visualization and business intelligence.

Each stream offers a set of electives. Students can choose from all electives offered by the programme which allows them to further specialize or to have a broader perspective in their programme. Students can choose to incorporate an internship (15 EC) in their programme as well. According to the committee, with these streams the programme offers a broad opportunity for students to learn about all aspects of Business Information Systems. The BIS curriculum is well in line with the profile of the programme. The committee observed that there is a good balance between information based and business based courses. As the new curriculum only started a few weeks before the visit, it was impossible for the committee to evaluate how it works out in practice.

A more detailed composition of the complete curriculum of BIS is given in Appendix 3.

All *master's programmes* conclude with a master thesis. Students work on an individual research or design project. They are supervised by a graduation supervisor, who is a faculty member. Students can choose to perform their final project in one of the research groups or in an external organization. SDE students are obliged to do their final project in a company. About 45% of the CSE students and 65% of the students in the Business Information Systems programme are going external. In that way they obtain experience in the professional field. The committee appreciates this connection with the professional field.

The teaching concepts of the master's programmes are based on the intended independent functioning of students. Most courses offer lectures to provide them with the necessary advanced knowledge from active researchers. Some courses offer practicals or tutorials. Comparing to the bachelor's programme, students of the master's programmes are expected to study and practice more independently. They work individually or in small groups on complex projects and assignments. Applying knowledge and enhancing academic skills are combined in these assignments. The committee concludes that the master's programmes use a wide range of appropriate teaching formats.

Scientific level and orientation
To chart the academic profile of the *bachelor's programme Computer Science and Engineering*, in 2006 an ACQA project group performed an analysis on the academic profile of the curriculum. It appeared that the main focus points are disciplinary competences and designing. The committee established that there is indeed a lot of attention for theoretical foundations in the programme. Doing research contributes for approximately 6% to the curriculum. As the previous assessment committee concluded that this research competence should be addressed more explicitly, the work group performed an in-depth analysis of this component. This resulted in some measures to increase the attention for research. Since 2009, the perceived percentage of research in the programme increased to 14.6%. Within the Web Science major, the actual attention for doing research is larger than in the Software Science major: the Web Science students perform user experiments. A detailed investigation of the academic profile of the new bachelor's programme is planned for 2015.

The *master's programme Computer Science and Engineering* has a more research oriented profile than the bachelor's programme. All teachers are active in research, in most courses students get introduced in recent research in the field of study. The capita selecta and research seminars prepare students for doing research in their master's thesis. The committee established that these are good instruments for the development of research skills and that there is a close

link with research in this programme. The committee is of the opinion that the development of academic research and writing skills is adequately addressed within the programme, but that the progression of these skills could be made more explicit.

The profile of the *master's programme Business Information Systems* is more business oriented. All courses are taught by staff members who are active in research and therefore establish an integration of education and research. Every student performs an individual research project during the master's thesis. Students of this programme are mostly interested in business aspects of computer science and therefore rarely continue their education in a PhD position.

The committee established that all staff members contributing to the three programmes have a PhD degree. All programmes use adequate scientific literature. The committee concludes that the scientific level of the programmes is adequate.

Study load, guidance and rates
The study yield of the *bachelor's programme Computer Science and Engineering* is a point of attention. Most recent data show that from the cohort 2009, after four years, 41% graduated. During the site visit, the programme management declared that the low study yield is partly a general Dutch problem. Many students have a job while they are studying. Research shows that students spend on average less than the nominal 40 hours per week on their study. Several measures have been taken to increase the study yield.

First of all the Binding recommendation for continuation of studies (BSA) has been introduced. In 2013 this has been raised from 30 EC to 40 EC, next year it will be raised to 45 EC. The first results of this measure show increasing study results in the first year of study. Second, the 'Harde knip' has been introduced in 2012/2013: Bachelor students need to complete their study completely before entering the master's programme. It is expected that this will also increase the study rate. Since 2007 the programme has increasingly worked with interim testing and homework assignments to stimulate students to have a more continuous study behavior.

Since the year 2006 the number of contact hours has been increased, under the assumption that more contact hours lead to better results. However, this was not the case, as students had too little time for self-study and assignments. Therefore, from 2010 on the number of contact hours have been reduced to 18 hours per week in the first and second year. In the third bachelor year 15 contact hours are scheduled. Besides these regular contact hours, during DBL projects group work is scheduled to enhance collaboration between students and to supervise their progress.

The introduction of a Basic Mathematics course has been issued to address potential gaps between secondary education and the level of the bachelor's programme. A basic mathematics course is part of the new Bachelor College curriculum as well. Students did not mention any difficulties with the transition from secondary education to the university.

Finally, the introduction of a quartile system has reduced the number of parallel courses and reduces the available weeks spent on courses. This should stimulate students to be more active from the beginning of a course.

The committee discussed the available guidance for bachelor's students. Every student has a study coach, which is a staff member. At least four times a year they meet, sometimes in small groups with other students. The coach helps students choosing their electives. Students who encounter problems can go to one of two available study advisors. Additionally a student

mentor is assigned to groups of ten students. This mentor meets them every fortnight to discuss practical issues and study skills. These student mentors are trained and receive regular guidance from the study advisor. Students appear to be very satisfied with the available guidance.

The committee concludes that the programme management has devoted substantial attention to the study success rates. Adequate measures have been taken and guidance is well available. The committee is positive about the underpinned policy on contact hours. The committee recommends to also establish targets for study success rates after three years.

Students with a bachelor degree in computer science from a Dutch university are admissible to both *master's programmes*. Students with a bachelor degree in Industrial Engineering from a Dutch University are admissible to the Business Information Systems master. As mentioned earlier, from September 2012 students are obliged to complete their bachelor's programme before entering the master's programme, the 'Harde Knip'. Students with a polytechnic HBO degree are offered a pre-master programme of 30 EC which allows them to develop an academic level and to proceed in a master's programme. Students with a different or foreign degree have to apply to the Admission Committee of the department.

Both programmes have recently transferred to a quartile system. This means that both study years are divided into four periods with a study load of 15 EC. This system spreads the study load more evenly over the year and reduces the number of parallel courses. Students reported some starting problems with this programme change: staff members need to adapt their planning of the courses and give feedback to students earlier. The committee understands that this change may have caused some start-up problems. They encourage the management to monitor that these problems will be addressed properly.

The study yield of both master's programmes is according to the committee rather low. Only 47% of transfer students finish their programme within 2 years. The average study duration is approximately 35 months. This will likely be reduced as a result of the 'Harde Knip' measure. HBO and international students are more successful: they do finish the Computer Science and Engineering programme in 24 months, their Business Information Systems programme in respectively 35 months (HBO) and 25 months (international). Based on this information the committee concludes that the master's programme is challenging from time to time, but no specific courses have been identified as bottlenecks.

Guidance is also available for master's students. First, they get advice on the composition of their elective programme from a staff member of the specialization where a student wishes to graduate. For more general study questions or problems students can go to the master's study advisor of the department. During their final project the thesis supervisor is available for guidance in this project.

To prevent students spending too much time on their master's theses, regulations have been introduced. Students need to have acquired at least 80 EC before starting their thesis. Approval of the Board of Examiners is needed to get an extension after nine months, and students need to start with a new project if they do not finish within twelve months.

To increase the feasibility of the Business Information Systems programme, the restructuring of the curriculum has created a more evenly distributed study load and more space for homologation courses.

The department strives to a success rate of 90% graduating in 2.5 years. The committee spoke with different panels about this ambition. It was not made clear to the committee what the programme will do to realize this ambition. The committee believes that additional measures will be necessary to realize the 90% goal.

One extra point that still deserves attention is the intake of female students in both the bachelor's and the master's programmes. In the committee's opinion, the number of female students is not yet satisfactory. In discussions it was emphasised that the programme is definitely addressing this issue with several measures. There is a gender policy for recruiting new staff members, who should function as a role model for students. The new Bachelor College with its broader design seems to have a positive effect in the intake of female students. The committee believes that this must remain a constant focus of attention and encourages the programme in its attempts to attract this target group.

Composition of the academic staff
All programmes are staffed by members of the department of computer science. Some courses of the Business Information Systems programme are taught by staff members of the department of industrial engineering. Staff members have an education load of 40 – 50 %, depending on whether they have management tasks. This load is increasing caused by the restructuring of the different programmes and new policies that prescribe more interim testing and coaching. The staff : student ratio of the department is 1 : 28. Until 2012 there has been a non-hiring policy, as a consequence the staff ratio decreased. Since 2012 the department has been allowed to hire new staff members.

The department tries to create a staff that is very strong in both research and education. All staff members have a PhD degree. Teaching quality is enhanced by the Basic University Teaching Certificate (BKO); 47% of the staff members have obtained this certificate. The department has the ambition to make this grow to 100% within three years. Teachers who enrol in the BKO training are compensated for their time investment. They need to keep a portfolio. As this portfolio was a barrier for some participants, facilities have been made available. Participants are offered a conference location and coaching to finalize their portfolios. Staff members told the committee that they perceived the BKO training as useful and well facilitated. They follow courses, get coaching and receive feedback on their own lectures. Besides the BKO programme, the department organizes Education Days twice a year to discuss developments on educational matters.

Both students and alumni appreciate the commitment and accessibility of the lecturers. During the site visit, the committee ascertained that the programmes are staffed with enthusiastic and motivated people. Even though there have been a lot of curriculum changes they appear to keep willing to realize the best education for their students. The committee hopes that in the coming years there will be more stability in the programmes.

Facilities and programme oriented quality assurance
All programmes are housed in the MetaForum building at the campus of the TU/e. While touring the facilities during the site visit, the committee obtained a good idea of the teaching facilities in this building. The lecture halls, instruction rooms and library are modern and there are project rooms available for students to work in groups. The teaching rooms, laboratories, work and study places greatly impressed the committee.

The electronic environment OASE is used within the TU/e for information exchange. Students can follow their study progress, get course information and consult their time schedules. Teachers can use OASE as a platform to store and distribute teaching materials.

Quality assurance of the program is ensured in several ways. First, all courses are evaluated with an online survey at the end of a quarter. The results of these surveys are analysed and discussed by the Evaluation Committee of the concerning programme. This committee consists of the programme director, study advisor, advisor of the Board of Examiners and the education policy advisor. The Evaluation Committee also performs a yearly evaluation of the programmes as a whole.

Each programme has a Study-programme Committee (OC). In this committee staff-members and students are equally represented. They discuss the results of the course evaluations and other matters concerning the quality and organisation of the programmes. The committee had a conversation with the OCs during the site visit and concluded that they serve as accessible representatives of students and teachers. The OC members indicate that they perceive that the programme management is proactive in the follow up of issues that the OC addresses. In order to have low barrier input from students concerning the bachelor's programme, the student association GEWIS organizes student-teacher meetings. The committee concludes that the programmes pay adequate attention to the quality of the programmes.

Considerations

The committee has studied the curriculum of the bachelor's programme Computer Science and Engineering and concluded that it is designed as a coherent programme that covers the intended learning outcomes of the programme. The design of the curriculum is clear, attractive and structured in coherent packages. Courses have clear learning objectives.

The bachelor's programme offers a lot of flexibility to students; they receive good guidance to make the right choices. The committee concludes that there are currently too few students going abroad during their bachelor's programme. Therefore they advise the programme management to stimulate and facilitate international exchange more actively.

The bachelor's programme uses several teaching concepts in order to realize different learning objectives. The committee highly appreciates the Design-Based Learning concepts, where students integrate and apply knowledge from different courses and practise professional skills as well. The committee is impressed by the set up and the results of the final SEP project.

The committee concludes that the curriculum of the master's programme Computer Science and Engineering is coherent and that the students are well prepared for obtaining their final qualifications. There is a close link between research and education. The research seminar, capita selecta and master's thesis enable students to become independent researchers. The course proposition is broad and flexible. The committee observed that as a result of the flexibility of the programme, many courses have to start at a basic level in order to enable students with different knowledge levels to participate in the course. This can interfere with realising an in-depth level within the span of a quarter.

The master's programme Business Information System has according to the committee a transparent and coherent programme. It offers four different streams that enable students to

follow a coherent package of courses that match their specific interests. The possibility to graduate externally offers students the opportunity to obtain professional experience during their education.

The study yield of all programmes is low. The committee established that the Bachelor's programme has taken several measures to enhance the study duration. The master's programmes have the ambition to increase the study yield to 90% of the students graduating in 2.5 years. The committee concluded that there is not yet a clear plan on how to realize this ambition.

The committee is enthusiastic about the facilities that are offered to students. The housing is modern and well equipped. Study guidance is sufficiently available for students.

The committee is very pleased with the teaching staff, in both quantitative and qualitative terms. There is a policy in place to promote the teaching skills of the lecturers. The committee is of the opinion that the programmes are well organized and that the students are well prepared for obtaining their final qualifications. It is impressed by the way in which the programmes are continuously focussing on quality improvement.

Conclusion

Bachelor's programme Computer Science and Engineering: the committee assesses Standard 2 as **good**.
Master's programme Computer Science and Engineering: the committee assesses Standard 2 as **satisfactory**.
Master's programme Business Information Systems: 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.

Findings

During the site visit the committee examined the assessment policy, the procedures regarding testing and examination and the assessment methods of the master's programme. To this end various assessment materials have been evaluated, such as students' exams and essays, portfolios, assessment keys, assessment forms and test exams. The assessments and assessment system were also discussed with students, the staff, the Board of Examiners (BoE) and the programme management.

To establish the achieved academic level of graduates, the committee assessed a sample of fifteen theses per programme. As the bachelor's programme has a group project as final work, the committee additionally assessed an individual essay of the course 'Knowledge systems and Datamining'.

Assessment organization and Board of Examiners

Two Boards of Examiners are responsible for the programmes assessed in this report. One BoE is responsible for the bachelor's and the master's programme Computer Science and Engineering and the other for the master's programme Business Information Systems. They are chaired by the same chair and responsible for safeguarding the quality of assessments and for checking that a successful student has met the graduation criteria. The TU/e has set up a training for members of Boards of Examiners where they learn about their legal responsibilities and the university-wide policies. All programmes have a Teaching and Examination Regulations (OER) document, which describes all regulations concerning assessments. All programmes work with assignments, written exams and some oral exams. Every course has at least one interim test. The committee studied a sample of exams of every programme. They concluded that the quality of the exams is good and that students demonstrate a high performance level.

The committee obtained a good overview of the instruments that the Board of Examiners has implemented in order to address their responsibilities.

First, every course has a responsible lecturer and a sparring partner. This ensures that every assessment is looked at by two different teachers. Assessment quality is addressed in the BKO training programme as well. As mentioned under Standard 2, the department has the ambition to enrol all teachers in the BKO training. The programmes have recently started working with test matrices to ensure that assessments are substantially related to the learning objectives of a course.

Second, the Board of Examiners has installed in 2006 a sub-committee: the *Borgingscommissie*. This committee investigates by sampling the assessment quality and the thesis quality. It analyses these samples and report its conclusions to the Board of Examiners. When

necessary, the Board of Examiners formulates an advice for the programme management to overcome observed problems. The committee is very positive about this *Borgingscommissie*. It appears that it is proactive in the investigation and safeguarding of the quality of assessments and of the graduation level. Additionally, the committee strongly recommends the Board of Examiners to set up an assessment plan for all programmes in order to monitor the assessment of the final qualifications of the programmes.

Regarding the prevention and treatment of fraud and plagiarism, the Board of Examiners declared that the responsibility has been delegated to the teaching staff. PEACH software is available for them to perform plagiarism scans. The committee is of the opinion that fraud should not only be addressed and monitored by individual teachers and therefore recommends to formulate a general fraud policy for the programmes.

A special point of attention is the assessment of group work. In the bachelor's programme, several group projects are part of the curriculum, including the final SEP project. With group-work, free-riding of individual students is a well-known problem. Students mentioned that free-riding does happen and that it frustrates them. The bachelor's programme has a peer-review system for all group projects. All group members give a midterm review of the other group members. If a student is underperforming in the group, the teacher discusses this with the student and he or she needs to show improvement, otherwise the student will be expelled from the group. For the final project, individual assessments are added to the project (see paragraph 3.2). The committee concludes that the programme management has recognized the problem of free-riding and has taken adequate measures.

Achieved academic level
The Critical Reflection Report describes the assessment of the SEP Project in the *bachelor's programme*. This protocol is published in the study guide of the course. Each project is assessed by two staff members: the technical advisor of the project-group and the SEP coordinator. There is an assessment form that describes the criteria for grading the project. In order to receive an individual grade, every student gives an individual oral presentation during the project. The peer-review of the SEP project influences the grading as well: depending on the peer-review a student receives up to one point in addition to or deduction of the group-grade. In the academic year 2013-2014, the programme runs a pilot with an individual oral exam on the SEP project, in order to increase the insight in the individual performance. The committee endorses the additional individual grading of the SEP projects.

The committee highly appreciates the quality of the SEP reports that it studied. The level of the essays is adequate as well. All students demonstrate an academic bachelor's level. However, according to the committee there should be more reflection of the students on the academic and personal process that they followed. In their portfolio, students do reflect on their education, but the committee holds the opinion that academic reflection should be a part of their projects and essays as well. The committee endorses the intensification of the individual assessment of final projects. The previously used assessment forms that the committee studied did not give a clear substantiation of the individual grades.

Master's programmes Computer Science and Engineering and Business Information Systems
The Critical Reflection Report describes the organisation and assessment of the *master's theses of both programmes*. The final mark for the thesis is awarded by the assessment committee. The constitution of the assessment committee is approved by the Board of Examiners, and it must consist of at least three members: (1) the chair, the supervisor of the project who is a full professor, associate professor, or assistant professor of the faculty, (2) the thesis tutor

(when a student carries out the project in a company, the tutor is a staff member of this company) (3) a member of a different research group of the department of computer science. The thesis work is presented in public, and afterwards defended for the assessment committee. The final mark is composed of scores for the quality of the thesis report, graduation presentation, defence and performance during the thesis project. The motivation is documented in an assessment report. This assessment report is conveyed to the student. The Board of Examiners receives the assessment report as well.

The committee agreed with the evaluations of the theses; the thesis assessment forms explain adequately how the thesis project or results (such as publications) have added to or reduced the final mark. As well as in the bachelor's reports, in some cases the committee observed a lack of critical reflection in the thesis. The committee was impressed by the overall quality of most of the theses it evaluated; it concluded that all master students whose thesis it could review, had well earned the right to graduate.

An alumni survey pointed out that 98% of the Computer Science alumni find a job after graduating. Job satisfaction is high as well: the average score is 4.2 on a 5 point scale. 52% of the alumni agree that a master's degree was required for their current job. 13% of the alumni continue after graduating to do a PhD, 52% start in a business or public company, 4% in a PDEng. 31% has not indicated their job type.

For BIS, all respondents of the alumni survey were employed. Their job satisfaction was 4.4. Almost all alumni work in a company or a public institution, for example as a consultant, business analyst, software developer or trainee.

Considering the thesis quality and the performance of alumni on the job market, the committee concludes that graduates of both programmes have realised the academic master's level.

Considerations

The committee confirmed that the assessment system of the programmes is adequate. Students are well informed about evaluation criteria and examination procedures. The Board of Examiners and university management have installed different instruments to safeguard assessment quality and graduation level. The committee appreciates the proactive role of the *Borgingscommissie* in this process. The committee was very pleased by the wide range of initiatives that the department took in the context of this standard and it appreciated very much the high standard of the assessment of the courses, the projects and the theses. The committee advises to complement the assessment policies with an assessment plan per programme and a general fraud policy.

To assess the final level realised by the students, the committee examined a range of final projects of all programmes. It concluded that the final level of the projects was high and matched with what could be expected of a graduate of a bachelor's or master's programme.

Conclusion

Bachelor's programme Computer Science and Engineering: the committee assesses Standard 3 as **good**.
Master's programme Computer Science and Engineering: the committee assesses Standard 3 as **good**.
Master's programme Business Information Systems: the committee assesses Standard 3 as **good**.

General conclusion

Conclusion

The committee assesses the *bachelor's programme Computer Science and Engineering* as **good**.
The committee assesses the *master's programme Computer Science and Engineering* as **satisfactory**.
The committee assesses the *master's programme Business Information Systems* as **satisfactory**.

Appendices

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

Prof. dr. em. J. (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 organized 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. W. (Wim) Van Petegem is a university professor at the KU Leuven and is also Director of Education and Learning. He completed his degree as a civil engineer at the University of Ghent and was awarded his doctorate in 1993 from the KU Leuven. He has worked at the University of Alberta, Edmonton (Canada), the Open University (The Netherlands), Groep T and the KHLeuven (Belgium). He teaches courses on multimedia production and the development of teaching materials (multimedia). His research interests encompass multimedia production, new teaching technology, networked e-leren, virtual mobility, lifelong learning, open and remote education, knowledge transfer ands scientific communication. In his specialist field he is involved in numerous international research, development and implementation projects as investigator, coordinator, partner or expert, and he is on the board of various international networks. Given his expertise he has already been a committee member for review committees, in Flanders, the Netherlands and further afield.

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. Sjouke Mauw is professor in Security and Trust of Software Systems at the University of Luxembourg since 2007. He studied mathematics at the University of Amsterdam and did a PhD in Computer Science at the same university. He was assistant professor at the University of Amsterdam (1988) and Eindhoven University of Technology (1992). In 1999 he became associate professor in Eindhoven. As a researcher he was also related to the CWI in Amsterdam. Sjouke Mauw is head of a research group focussing on formal methods in the areas of security en trust. He has also published in various other areas like process algebra, domain specific languages, testing, distributed algorithms and bio-informatics.

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

Domain-specific frame of reference for Bachelor-level courses in Computer Science

De *Joint Task Force for Computing Curricula* van de samenwerkende organisaties ACM en IEEE-CS geeft in haar (draft) rapport *Computer Science Curricula 2013 (Strawman Draft*) richtlijnen opgesteld voor bacheloropleidingen Informatica. Het *Strawman Draft* is door de TUD opgevat als referentiepunt en karakteriseert zichzelf aan de hand van (1) elf karakteristieke competenties (*Characteristics of Graduates)* en (2) achttien kennisgebieden (*Knowlegde Areas*). Als derde onderdeel wordt de door de TUD gemaakte vergelijking tussen de Academische criteria van Meijers et al. (2005) (3TU-criteria) en de competenties van het domeinspecifieke referentiekader Informatica. De aansluiting van de leerdoelen op de 3TU-criteria is als vierde onderdeel in deze bijlage opgenomen.

Characteristics of Graduates
At a broad level, the expected characteristics of computer science graduates include the following:

1. **Technical understanding of Computer Science.** Graduates should have a mastery of computer science as described by the core of the Body of Knowledge.
2. **Familiarity with common themes and principles.** Graduates need understanding of a number of recurring themes, such as abstraction, complexity, and evolutionary change, and a set of general principles, such as sharing a common resource, security, and concurrency. Graduates should recognize that these themes and principles have broad application to the field of computer science and should not consider them as relevant only to the domains in which they were introduced.
3. **Appreciation of the interplay between theory and practice.** A fundamental aspect of computer science is understanding the interplay between theory and practice and the essential links between them. Graduates of a computer science program need to understand how theory and practice influence each other.
4. **System-level perspective.** Graduates of a computer science program need to think at multiple levels of detail and abstraction. This understanding should transcend the implementation details of the various components to encompass an appreciation for the structure of computer systems and the processes involved in their construction and analysis. They need to recognize the context in which a computer system may function, including its interactions with people and the physical world.
5. **Problem solving skills.** Graduates need to understand how to apply the knowledge they have gained to solve real problems, not just write code and move bits. They should also realize that there are multiple solutions to a given problem and that selecting among them is not a purely technical activity, as these solutions will have a real impact on peoples lives. Graduates also should be able to communicate their solution to others, including why and how a solution solves the problem and what assumptions were made.
6. **Project experience.** To ensure that graduates can successfully apply the knowledge they have gained, all graduates of computer science programs should have been involved in at least one substantial project. In most cases, this experience will be a software development project, but other experiences are also appropriate in particular circumstances. Such projects should challenge students by being integrative, requiring evaluation of potential solutions, and requiring work on a larger scale than typical course projects. Students should have opportunities to develop their interpersonal communication skills as part of their project experience.

7. **Commitment to life-long learning.** Graduates of a computer science program should realize that the computing field advances at a rapid pace. Specific languages and technology platforms change over time. Therefore, graduates need to realize that they must continue to learn and adapt their skills throughout their careers. To develop this ability, students should be exposed to multiple programming languages, tools, and technologies as well as the fundamental underlying principles throughout their education
8. **Commitment to professional responsibility.** Graduates should recognize the social, legal, ethical and cultural issues involved in the deployment and use of computer technology. They should respond to these issues from an informed perspective, guided by personal and professional principles. They must further recognize that social, legal, and ethical standards vary internationally.
9. **Communication and organizational skills.** Graduates should have the ability to make succinct presentations to a range of audiences about technical problems and their solutions. This may involve face-to-face, written, or electronic communication. They should be prepared to work effectively as members of teams. Graduates should be able to manage their own learning and development, including managing time, priorities, and progress.
10. **Awareness of the broad applicability of computing.** Platforms range from embedded micro-sensors to high-performance clusters and distributed clouds. Computer applications impact nearly every aspect of modern life. Graduates should understand the full range of opportunities available in computing.
11. **Appreciation of domain-specific knowledge.** Graduates should understand that computing interacts with many different domains. Solutions to many problems require both computing skills and domain knowledge. Therefore, graduates need to be able to communicate with, and learn from, experts from different domains throughout their careers.

Knowledge Areas

Knowledge area	Core	
AL Algorithms and Complexity	28	9%
AR Architecture and Organization	16	5%
CN Computational Science	1	0%
DS Discrete Structures	41	13%
GV Graphics and Visual Computing	3	1%
HC Human-Computer Interaction	8	3%
IAS Security and Information Assurance	8	3%
IM Information Management	10	3%
IS Intelligent Systems	10	3%
NC Networking and Communication	10	3%
OS Operating Systems	15	5%
PBD Platform-based Development	0	0%
PD Parallel and Distributed Computing	15	5%
PL Programming Languages	28	9%
SDF Software Development Fundamentals	42	14%
SE Software Engineering	27	9%
SF System Fundamentals	27	9%
SP Social and Professional Issues	16	5%
Total	305	100%

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

Learning outcomes in general
The Dublin descriptors indicate in general terms what levels a student should reach in knowledge and understanding, the application of knowledge and understanding, forming judgments, communication and learning skills to award him the master's title. In the objectives and content of a Master's degree module it must be clear that teaching and assessment of students aims at reaching the goals set in the Dublin descriptors. They are as follows.

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.

Domain specific contents, the nature of Master degree modules

The Master's degree module 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 degree 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 module will generally concentrate on subjects in a limited specialisation within the field, or in the border region with adjacent fields. If the module 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 modules have identified a (international) community of modules of a similar nature and they will fit the standards of that community.
The Master's degree module 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 module and research activities, and researchers are active as lecturers and supervisors in the degree module.

[1] 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.

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 module there will be a final project that takes at least one quarter of the entire module. In the final project the student can show his capabilities in each of the five fields of the Dublin descriptors (knowledge and understanding, application of knowledge and understanding, forming judgments, communication and learning skills).

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 module 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 module must address the development of skills and competencies that are essential for a working professional. It must be possible for students to participate in cooperation with trade and industry, in particular during a final project. This requires the modules to have sufficient contacts within trade and industry.

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

Bachelor's programme

The overall objective of the bachelor's programme is to train and educate young professionals who are able to progress into an appropriate Masters program and/or are prepared to embark upon a professional career in the fields of software science or web science. Students are therefore expected to:

1. acquire cognitive skills relating to computer science and engineering;
2. acquire practical capabilities and skills relating to software design (the Web Science major focuses on complex internet-based applications, while the Software Science track is more concerned with technical applications);
3. acquire professional and generic academic skills.

Qualifications Students who complete the program are awarded a BSc degree, which is evidence of the following skills and competencies:

1. Basic knowledge and skills in computer science and engineering:
   - familiarity with basic concepts related to Software Science/Web Science, and a subset of other computer science domains;
   - a thorough technical and scientific understanding of software and software systems;
   - the ability to rapidly deduct the essence of such systems, to acquaint him/herself with those systems and to judge its merits.

2. Software design:
   - the ability to develop programs or software systems in an effective and structured manner, whereby those systems will perform the tasks expected of them accurately and efficiently;
   - the ability to analyze any software system in terms of its behavioral aspects, including performance;
   - further to this analysis, the ability to adapt and improve the system where necessary;
   - the ability to document all findings and activities for future reference.

3. General academic skills:
   - the ability to acquire further knowledge in the field of computer science and to do so independently;
   - an awareness of the position and importance of computer science within society,
   - an awareness of the rapid changes, both positive and negative, which information technology can bring about, and the ability to reflect on such changes;
   - the ability to work effectively within a team;
   - the ability to impart information, ideas and solutions to either fellow specialists or a lay public;
   - the ability to plan and organize ones own work as well as a software development project.

Master's programmes

A graduate from the master program CSE and BIS:

- is qualified to degree level in the domain of science, engineering and technology;
- is competent in the relevant domain-specific discipline, namely computer science and
- engineering;
- is capable of acquiring knowledge independently;
- approaches computer-science problems in a thorough and scientifically founded manner;
- is capable of critical thinking, can reason logically and form opinions;
- has design skills, presentation skills, and communication skills;
- has insight into the role of computer science in industry, society, and science;
- and, in addition to a recognizable domain-specific profile, possesses a sufficiently broad basis to be able to work in an interdisciplinary and multidisciplinary context.

Additional intended learning outcomes IST

Beside the general intended learning outcomes, which we just discussed in the relation to the domain-specific frame-of-reference, the IST program has some additional and more specific learning outcomes: A graduate from the special master track IST:

- has a broad view of information security;
- should be able to evaluate existing and newly designed security systems;
- should be able to list relevant security requirements in an application and to select the right techniques to address these issues;
- is an expert in at least one subarea of information security;
- can contribute to discussions about the role of information security in our society;
- has experience in the process of specifying, designing, and realization of an application in which security plays an important role.

Additional intended learning outcomes SDE

The additional intended learning outcomes for the SDE program are as follows. A graduate from the special master track SDE

- has the technical expertise to develop and analyze software-intensive service applications and information systems;
- understands business aspects and behavioral, legal, and societal aspects of modern information systems and services;
- can analyze the user and organizational needs for services and their decomposition;
- can propose novel and innovative services with sustainable business models.

These learning outcomes cover the specific skills and knowledge that SDE graduates should possess in the area of service design, as well as the innovational and entrepreneurial spirit that the graduates should have developed.

Additional intended learning outcomes BIS

A BIS graduate should also:

- possess knowledge of the mathematical formalisms, methods, tools and their mutual dependencies needed to understand and model business processes and data;
- have the engineering skills needed to apply this knowledge to design high-quality business information systems;
- understand the role of IT in the context of organizations, business processes and their management.

Appendix 4: Overview of the curricula

Bachelor's programme

Figure 1: Study programme Software Science

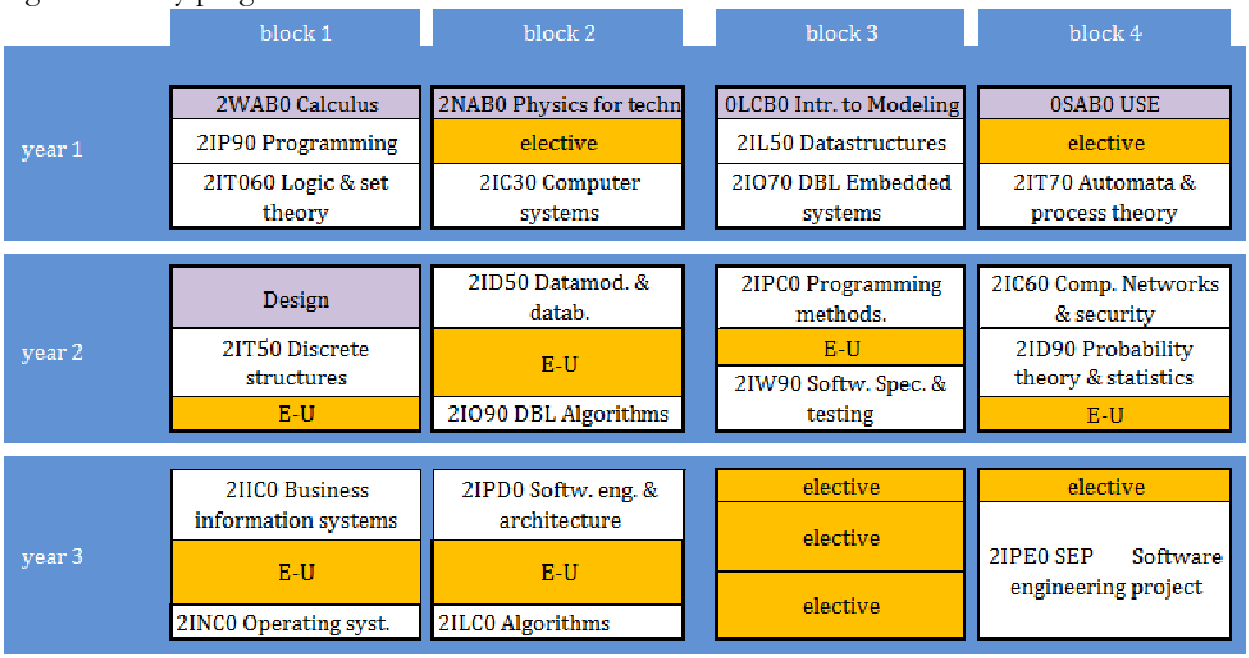
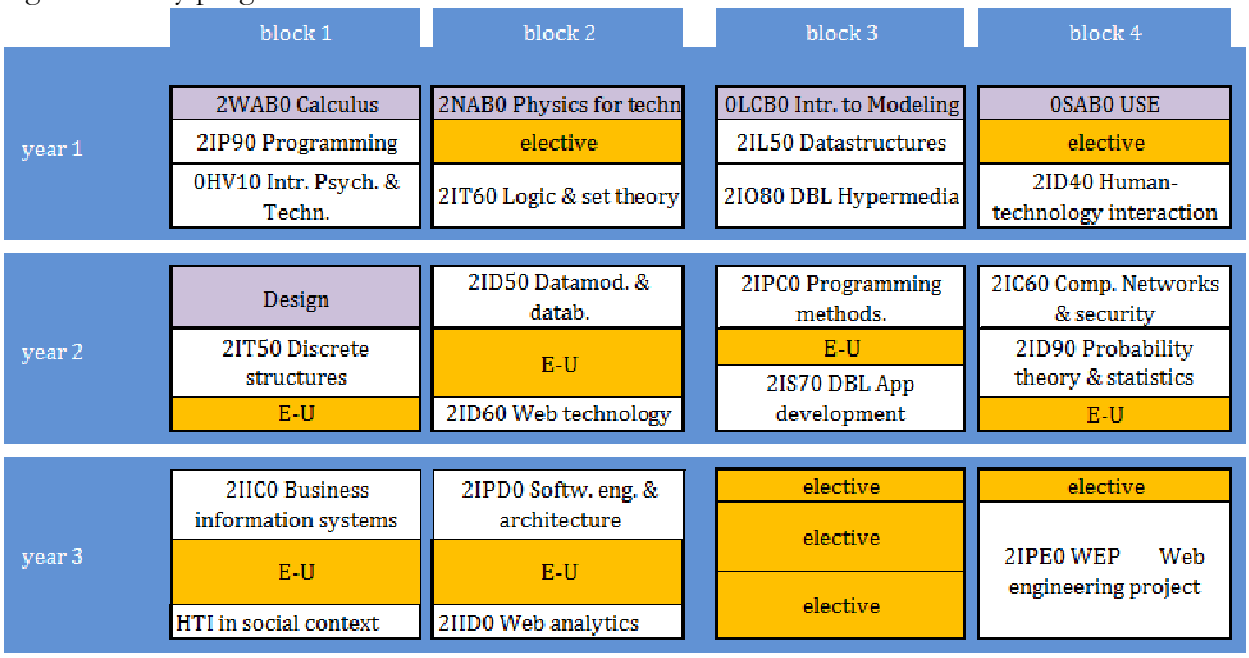


Figure 2: Study programme Web Science

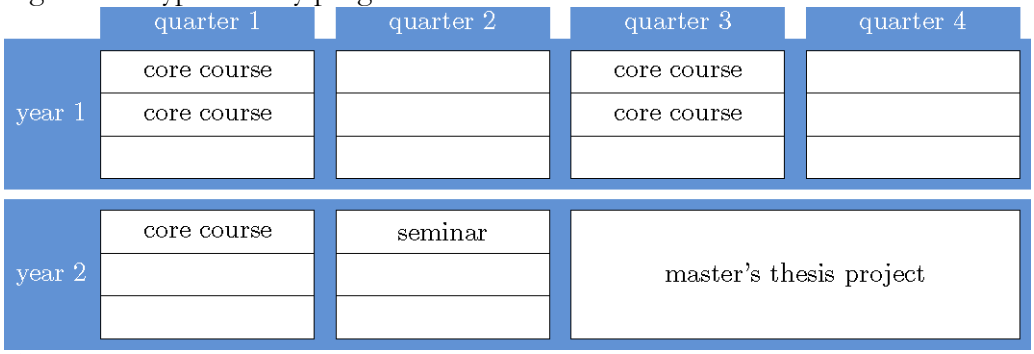


Master's programme

The CSE curriculum offers students ample opportunity to define their own personal study program. The only requirements are that students take at least five our of the eight core courses, and a seminar (and, of course, the master's thesis project). The core courses are scheduled in quarters 1 and 3, while the seminars are scheduled in quarters 2 and 4. This way all students, no matter whether they enter the program in September or February, can do any core course in either the first, third, or fifth quarter of their studies, and they can do

any seminar in either the fourth or sixth quarter. (The only exceptions are the core course and seminar in security, which are scheduled as semester courses to align them better within the IST program.)

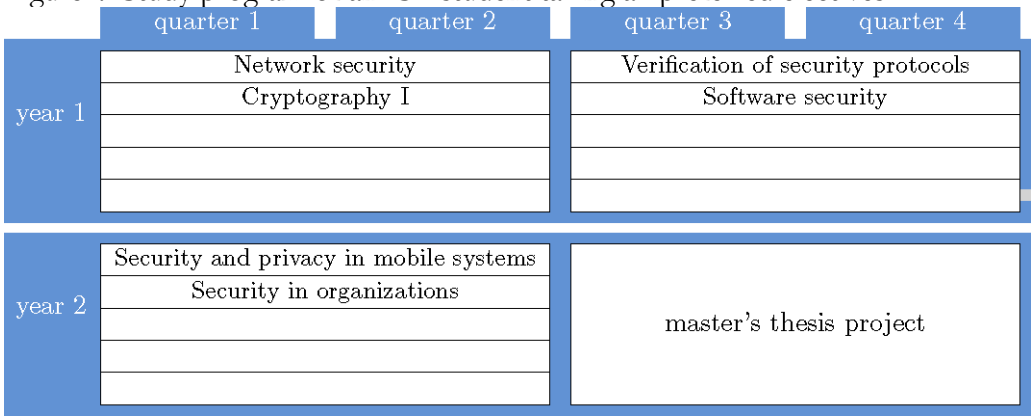
Figure 3: A typical study program of a CSE student



The white slots indicate electives.

The IST curriculum consists of six core courses, a number of electives, and the master's thesis project. The core courses and the preferred electives are 6-credit semester courses. Fig. 4 shows an example of the resulting study program. There are nine preferred electives in total. Students can replace some of these electives by courses from the regular CSE program, as long as they keep at least three preferred electives. Note that the regular CSE program consists of 5-credit courses in a quarter system, so choosing such electives makes for a somewhat unbalanced program. (A typical study program would for example have one semester with 34 credits, two semesters with 28 credits, and one semester with 30 credits.) This is undesirable, but as long as the systems in the three universities are different it is hard to avoid. Moreover, students do not seem to find this a big issue.

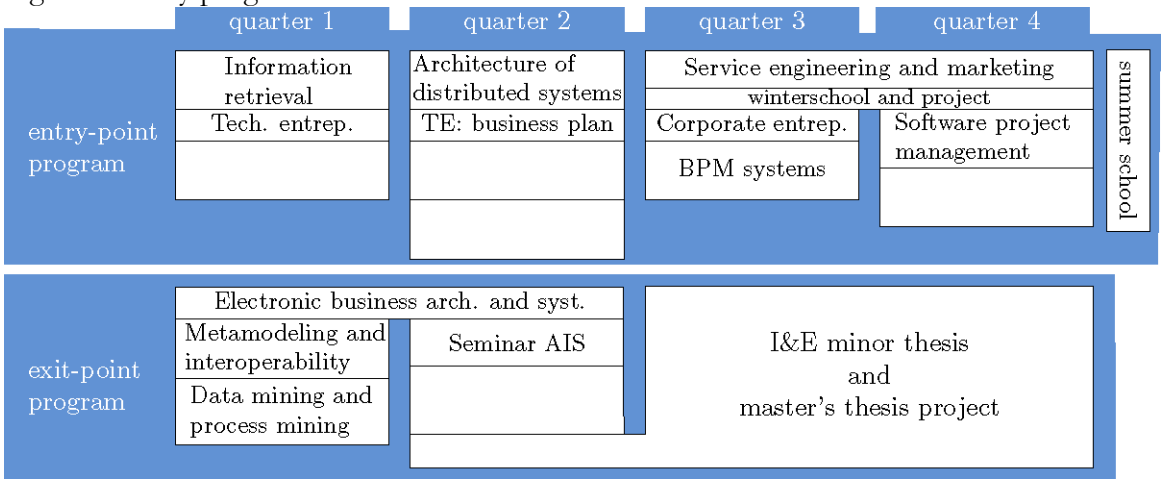
Figure 4: Study program of an IST student taking all preferred electives



The white slots indicate the electives.

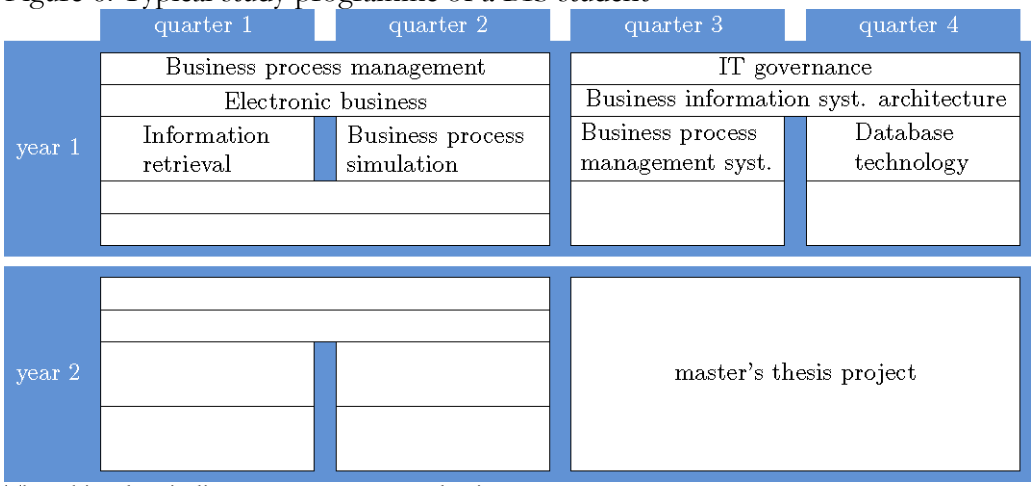
Fig. 5 gives an overview of the SDE curriculum. Note that any student in the SDE program either follows the first year in Eindhoven, or the second, but not both. The technical topics covered in the mandatory courses in the first year, however, are covered at each of the other entry points as well—together they form the so-called common base of the program—and the same holds for the I&E module. Hence, the exit points can rely on a suitable basis among the entering students, irrespective of the entry point they come from. More information on the programs at the partner institutions can be found at the ICT Labs website on the SDE program: http://www.masterschool.eitictlabs.eu/programme/majors/sde/.

Figure 5: Study programme of an SDE student. The white slots indicate the electives



The BIS programme consists of core course, stream courses, electives and the master thesis project. Figure 6 gives an overview of the curriculum. As electives, essentially all master's courses offered within the CSE programme and by the Department can be chosen.

Figure 6: Typical study programme of a BIS student



The white slots indicate stream courseor electives.

Appendix 5: Quantitative data regarding the programmes

Data on intake, transfers and graduates

Bachelor's programme

Intake of the BTI program.

Intake cohort	VWO	HBO prop	HBO	International	Other	Total
07/08	41	0	17	0	1	59
08/09	52	3	28	1	3	87
09/10	54	2	38	3	1	98
10/11	58	3	28	2	0	91
11/12	72	4	20	5	6	107

Dropout rate after 1, 2 and 3 years (vwo-intake).

Cohort	2005	2006	2007	2008	2009	2010	2011
Number	42	51	41	52	54	58	72
Dropout rate after 1jr	29%	18%	39%	38%	43%	29%	26*
Dropout rate after 2jr	43%	31%	56%	50%	43%	34*	
Dropout rate after 3jr	45%	31%	54%	52%	44*		
Selectivity First year	63%	56%	73%	74%	96*		
% drop-outs switched to HBO	42%	38%	50%	56%	71*		

* preliminary figures at October 1 (date of measurement)

Study yield in Bachelor program of students re-enrolling after 1 year (vwo-intake)

Cohort	2005	2006	2007	2008	2009
Re-enrolled	30	42	25	32	31
(% of total en-rolled)	(71%)	(82%)	(61%)	(62%)	(57%)
Success rate after 3 years	30%	14%	4%	19%	32%
Success rate after 4 years	33%	36%	24%	44%	
Success rate after 5 years	50%	52%	44%		
Success rate after $6^{(+)}$ years	67%	74%			

Study yield in Bachelor program of students re-enrolling after 1 year (total intake)

Cohort	2005	2006	2007	2008	2009
Re-enrolled	43	55	36	43	55
(% of total en-rolled)	(53%)	(69%)	(61%)	(49%)	(56%)
Success rate after 3 years	23%	13%	3%	14%	18%
Success rate after 4 years	26%	31%	17%	35%	
Success rate after 5 years	40%	44%	31%		
Success rate after $6^{(+)}$ years	53%	60%			

Master's programme Computer Science and Engineering

Intake in the CSE programme, including IST and SDE

Intake cohort	Total	Transfer	Other TU/e	HBO	Other NL	International
2007	60	34	0	6	0	20
2008	55	22	1	14	0	18
2009	46	17	1	8	0	20
2010	60	23	2	9	0	26
2011	60	21	2	15	2	20
2012	53	14	2	7	5	25

The category transfer concerns students from the computer science bachelor program, other TU/e concerns students from another TU/e bachelor program (admissible via a deficiency program), HBO concerns students that completed the pre-master program, other NL concerns students from other Dutch universities, and international concerns our international students.

Study yield CSE after two and three years.

Intake cohort	Transfer		Other TU/e		HBO		Other NL		International	
	2 yrs	3 yrs	2 yrs	3 yrs	2 yrs	3 yrs	2 yrs	3 yrs	2 yrs	3 yrs
2007	24%	62%	-	-	33%	50%	-	-	60%	80%
2008	9%	55%	0%	-	36%	57%	-	-	78%	83%
2009	47%	76%	0%	-	0%	50%	-	-	75%	90%
2010	0%	-	50%	-	11%	-			73%	-

The percentages after three years are cumulative. Some entries are not filled either because the relevant population is empty, or because it is too early to report the number.

Study duration CSE in months

Exit cohort	Transfer	Other TU/e	HBO	Other NL	International
2008	28.2	36.0	40.0	36.0	29.1
2009	32.6	-	38.8	-	28.9
2010	34.3	60.0	38.0	58.0	25.2
2011	37.4	-	24.0	-	24.5

Master's programme Business Information Systems

Intake in the BIS programme

Intake cohort	Total	Transfer	Other TU/e	HBO	Other NL	International
2007	27	15	0	4	0	8
2008	27	14	0	1	0	12
2009	35	18	0	2	0	15
2010	28	10	0	1	0	17
2011	26	15	0	0	0	11
2012	22	11	0	4	0	7

Table 9 Study yield BIS after two and three years

Intake cohort	Transfer		Other TU/e		HBO		Other NL		International	
	2 yrs	3 yrs	2 yrs	3 yrs	2 yrs	3 yrs	2 yrs	3 yrs	2 yrs	3 yrs
2007	0%	27%	-	-	75%	100%	-	-	63%	88%
2008	7%	29%	-	-	-	-	-	-	8%	42%
2009	6%	44%	-	-	50%	100%	-	-	27%	73%
2010	10%	-	-	-	-	-	-	-	47%	-

Table 10 Study duration BIS in months

Exit cohort	Transfer	Other TU/e	HBO	Other NL	International
2008	30.7	-	25.3	-	24.0
2009	40.4	-	40.5	-	27.3
2010	37.4	-	24.0	-	25.5
2011	35.7	-	35.0	-	25.2

Teacher-student ratio achieved

Student/staff ratio in the computer science department december 1, 2012

Year	Undergraduate no. students	Graduate no. students			Total no. students	Teac hing FTE	Student/ staff ratio
	BTI	BI	CS	E			
2006	372	51	157	29	609	21.5	28.3
2007	341	56	177	49	623	23.0	27.1
2008	341	72	166	54	633	23.7	26.7
2009	333	80	147	67	627	26.0	24.1
2010	321	76	140	83	620	26.0	23.8
2011	322	62	142	97	623	24.9	25.0
2012	331	58	154	95	638	22.7	28.1

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

Bachelor's programme
contact hours during regular quarters: 15-24 hours/week
contact hours during final project: 4 hours/week

Appendix 6: Programme of the site visit

Site-visit assessment committee TU/e 12 / 13 September 2013

Thursday 12 September			
12.00	15.00	Preparatory meeting of the Committee + review of documentation	
15.00	15.45	Management (Dpt. Board + educ. Management)	Aarts; van den Brand; de Berg; Lierop; Lemmens; Westenberg; de Haan
15.45	16.30	Program coordinators + cur. advisors	Lierop; De Bra; van den Brand De Berg; van Dongen; Skoric; Serebrenik
16.30	17.30	Students	Luna Li (MSc CSE); Josh Mengerink (CSE); Krzysztof Okupski (CSE-IST); Maikel van Eck (BIS); Jeroen van Wijgerden (BTI-SfS); Sylvester Kogowski (BTI-WbS)
17.30	18.00	Alumni	Mike van Bussel (BIS), KPMG IT Advisory; Stef van den Elzen (CSE), PhD TU/e Visualization / SynerScope BV; Can Eren (BIS), ECM Consultant, Cap Gemini; Ashwini Moily (CSE), Software Engineer, Bosch Security Systems; Bram Schoenmakers (CSE), Design engineer, ASML; Stan Damen (CSE-IST), IT security officer, Vanderlande Industries
18.00	18.30	Meeting of the assessment committee (internal)	
19.30		Dinner (committee only)	
Friday 13 September			
9.00	10.00	Teaching Staff	Somers; Huizing; Ozcelebi; van der Aalst; Fletcher, Willemse; van Wijk
10.00	10.30	Study Programme Committee	Luttik; Zantema; Dijkman; De Kock; de Smet; Claessen;
10.30	11.15	Board of Examiners and study advisors	Groote; De Bra; Lukkien; Bloo; Veltkamp, Grefen; Kaasschieter (adv.)
11.15	11.45	Office hour	
11.45	13.00	Lunch and preparation meeting of the committee for the end session with the management	
13.00	13.45	End session management	(Aarts); van den Brand; Groothuis; de Berg; Lierop; Westenberg; de Haan;
13.45	15.30	Preliminary findings and preparation presentation (committee)	
15.30	16.00	Presentation by the chair of the committee	
16.00	17.00	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:

Bachelor's Theses

0654113	0633565	0654181
0653349	0552099	0640773
0590864	0661574	0596312
0655541	0655006	0722672
0630673	0519199	0574728
0607426	0632157	0637070
0610024	0632607	

Master's Theses

757972	666436	590781
520730	729538	565895
729000	578052	0755007
754744	0596768	0760921
666905	567394	573419
612291	755956	542914
756619	756565	0547649
0788625	0608141	0568036
0788401		

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):

Verslagen van overleg in relevante commissies / organen:
a) Opleidingscommissie BTI
b) Opleidingscommissie CSE
c) Opleidingscommissie BIS
d) Examencommissie BTI/CSE
e) Examencommissie BIS
f) Borgingscommissie
g) Jaarverslag facultaire toelatingscie
h) Jaarverslagen examencommissies

De volgende vakken:
BIS WEB INFORMATION SYSTEMS, 2II35
BIS : BPM
CSE : System validation 2IW26
CSE: Verification of security protocols 2IF02
BTI
2IL50 Data structures,
2ID05 Datamodelling & databases
2IP15 Programming Methods
2io70 DBL Embedded Systems
2IO80 DBL Hypermedia
2II15 Datamining en kennissystemen

Per geselecteerd vak:
a) toetsopgaven met bijbehorende beoordelingscriteria en normering (antwoordmodellen) en
b) een representatieve selectie van feitelijk gemaakte toetsen (zoals presentaties, stages, assessments of portfolio's) en beoordelingen en ogo-produkten;
c) studeerwijzer (=bij ogo projectwijzer)
d) toetsplan bij BC
e) verplichte literatuur en overig studiemateriaal dus ook prints van via internet beschikbare verplichte literatuur

Voorbeelden van werkstukken, portfolio's, onderzoeksverslagen van studenten, stageverslagen:
a) Artikelen studenten
b) Recente afstudeerverslagen
c) Recent sepverslag en produkt
d) Voorbeelden van Portfolio's, en verslagen Jacob
e) Beschrijving professionele vaardigheden en beoordelingsformulieren

reglementen:
a) Scriptiereglementen en richtlijnen voor het maken van werkstukken:
b) GRADUATION MANUAL Master, inclusief graduatuion form 2013-14
c) SEP manual, inclusief beoordelingsform.
a) OER en examenregeling BTI, CSE BIS 2013-14
b) Richtlijn overkoepelende afspraken m.b.t. bewaking kwaliteit keuzepakketten
d) Stagereglement / handleiding bachelor
e) Stagereglement master

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;

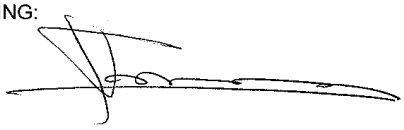
VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

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

PLAATS: Antwerpen

DATUM: 26.4.13

HANDTEKENING:



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: Leuven

DATUM: 25 juli 2013

HANDTEKENING:

nvao

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: Sjouke Mauw

PRIVÉ ADRES:

20, RUE TH. GILLEN
L-1625 HOWALD LUXEMBURG

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

INFORMATICA

AANGEVRAAGD DOOR DE INSTELLING:

VSNU / QANU
RUG, TU6, UU, UvA, VU

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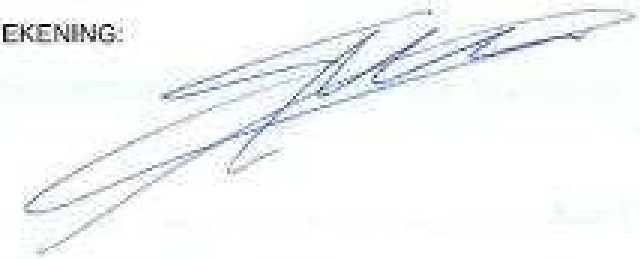
VERKLAART STRIKTE GEHEIMHOUDING TE BETRACHTEN VAN AL HETGEEN IN VERBAND MET DE BEOORDELING AAN HEM/HAAR BEKEND IS GEWORDEN EN WORDT, VOOR ZOVER DE OPLEIDING, DE INSTELLING OF DE NVAO HIER REDELIJKERWIJS AANSPRAAK OP KUNNEN MAKEN.

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

PLAATS: Eindhoven DATUM: 3/4/13

HANDTEKENING:



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nederlands - vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: WIM VAN PETEGEM

PRIVÉ ADRES: FAZANTENLAAN 1
B-3010 KESSEL-LO
BELGIE

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

INFORMATICA

AANGEVRAAGD DOOR DE INSTELLING:

TU Delft, RUG, TU/e, Radboud en UTwente

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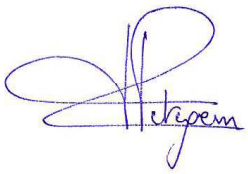
VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS: LEUVEN DATUM: 29/3/2013

HANDTEKENING: 

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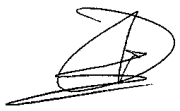
VERKLAART HIERBIJ OP DE HOOGTE TE ZIJN VAN DE NVAO GEDRAGSCODE.

PLAATS:
Antwerpen

DATUM:
26-4-2013

HANDTEKENING:



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nederlands-vlaamse accreditatieorganisatie

ONAFHANKELIJKHEIDS- EN GEHEIMHOUDINGSVERKLARING

INDIENEN VOORAFGAAND AAN DE OPLEIDINGSBEOORDELING

ONDERGETEKENDE

NAAM: José van Zwieten

PRIVÉ ADRES:

Croesestraat 17
3522 AA Utrecht

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

Informatica

AANGEVRAAGD DOOR DE INSTELLING:

TU Eindhoven

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:

2