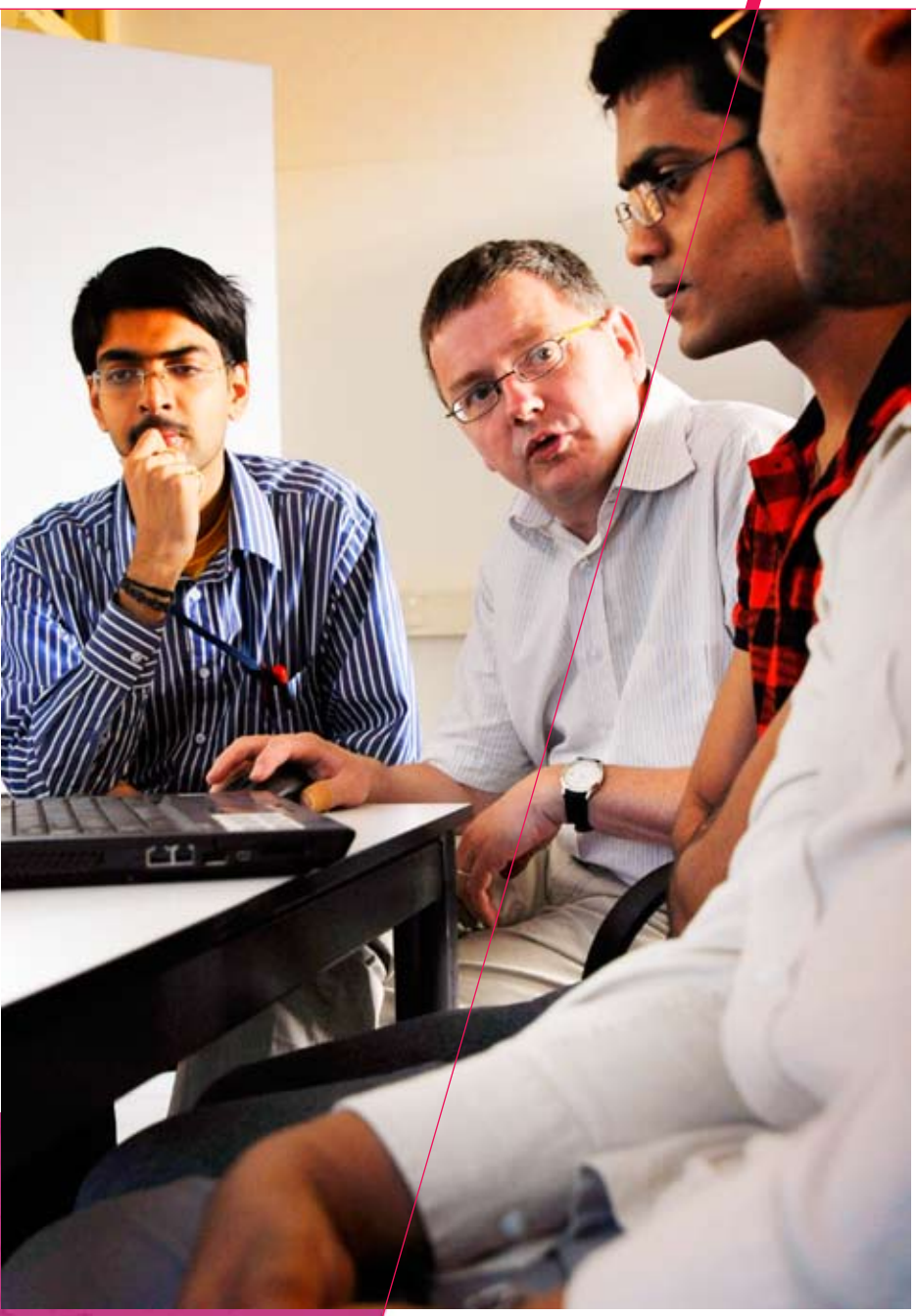
Technische Universiteit
Eindhoven
University of Technology



Computer Science and Engineering

Master Program Guide 2010-2011

Where innovation starts

Master Program Guide 2010-2011 Computer Science and Engineering

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Suggestions for improvements, amendments or changes can be directed to the editor, e.v.d.hurk@tue.nl.

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1. The Department and Master programs

The Department of Mathematics and Computer Science (W&I) at the *Technische Universiteit Eindhoven* (TU/e) offers undergraduate (Bachelor of Science), graduate (Master of Science) and postgraduate (PhD, PDEng) courses in Applied Mathematics and Computer Science.
The Mathematics Division focuses on Discrete Mathematics, Stochastics and Optimization, and Scientific Computing and Analysis. The Computer Science Division (CS) is mainly concerned with Specification and Verification, Algorithms and Visualization, Software and Systems Engineering, Information Systems, and Security. Department members take part in numerous research projects, cooperating with other universities and commercial enterprises, both nationally and internationally.

The Mathematics and Computer Science Department offers four Master of Science degrees, three of which are in the Computer Science Division:

- Computer Science and Engineering (CSE),
- Business Information Systems (BIS), in cooperation with the Department of Industrial Engineering and Innovation Sciences (IE&IS),
- Embedded Systems (ES), in cooperation with the Department of Electrical Engineering.

The fourth one is Industrial and Applied Mathematics (IAM) in the Mathematics Division.

In addition, two special Master of Technological Design (PDEng) programs are offered; Software Technology and Mathematics for Industry, which are exemplary because of the Mathematics and Computer Science Department's emphasis on applications.

This master program guide applies to the Master of Science in Computer Science and Engineering (CSE) program and is intended for all CSE students. A master program guide is also available for the Master of Science in Business Information Systems, in Embedded Systems and in Industrial and Applied Mathematics.

2. general course and program information

2. General Course and Program Information

This chapter provides information about the structure and organizational aspects of the master programs. The CS Division offers several master programs, all with some aspects in common. The focus of this chapter is on these commonalities.

2.1 Master programs

Four master programs are offered, one of which is offered as a specialization within the master program CSE (in anticipation of an independent status as a full master program in the future):

- Computer Science and Engineering (CSE). This master program has a special track:
  - Information Security Technology (IST), an interdisciplinary variant in cooperation with the Mathematics Division of the TU/e, and the Radboud University in Nijmegen, and the University Twente.
- Business Information Systems (BIS), an interdisciplinary master program in cooperation with the Department of Industrial Engineering and Innovation Sciences (IE&IS).
- Embedded Systems (ES), an interdisciplinary master program in cooperation with the Department of Electrical Engineering (E).

The CS Division also contributes in the Computer Science specialization of the master program Science Education and Communication (SEC), offered by the Eindhoven School of Education (ESoE), see www.esoe.nl/en/education. Graduates in the CS specialization from the program are entitled to teach computer science at Dutch high schools. Graduates from one of the above mentioned master programs will also be admitted to the SEC-program and are offered a one-year program. From 2009 on, double-degree programs are offered for CSE & SEC, as well as for BIS & SEC, which comprise 160 credits, see section 3.5 for more details.

The special flavors of the CSE and IST master programs and their translation into details of substance will be discussed in chapter 4.

2.2 Goals

After the master program, the graduates will have the following competences:

1. a. In-depth knowledge of the foundations of computer science.
   b. Insight into formalisms, methods, tools and their mutual relations.
   c. Insight into the relationships within the field of computer science and the power to follow important topical developments within the field.
2. a. Be capable of designing or redesigning complex computerized systems in a structured way, to allow these systems to carry out their tasks in a correct and efficient way.
   b. Have sufficient insight into the principles of design methods to make an argued choice for a specific methodology for a concrete situation.
3. a. Be capable of carrying out research assignments in a responsible scientific fashion and be able to report about the assignments.

2.3 Structure of the master programs

All programs comprise two years of study or 120 credit points (ects); a credit point is equivalent to 28 hours of study and homework for an average student. Most courses are standardized to 5 credit points per course.
The two years of course work and practical training are divided into three parts, consisting of:

1. Mandatory core courses to create a sufficient layer of theory and general or program related knowledge.
2. Elective courses will serve as preparation for the specialization. For CSE-students it is, under some conditions, possible to allot up to 15 credit points towards an internship with approval in advance from the Examinations Committee. Students with a slightly different background may need to allot some electives to compensate for deficiencies. Further information you find in chapter 3.1.2.
3. Master project and thesis are to be spent on a specialist topic of theoretical or practical nature. This part presents the opportunity to show your independent engineering and academic skills in research and design.

2.4 Lecture and interim examination periods

Each study year is divided into two semesters (September – January and February – July). Each semester consists of two quarters, each consisting of eight weeks of lectures followed by an examination period of two weeks. For details see the agendas and calendars at owinfo.tue.nl.

2.5 Examination and titles

There is only one examination at the end of the program. In which the examination committee verifies and judges the final course results and the final master project grade. Completion of the program will lead to the title: Master of Science (MSc) with addition of the name of the program. Graduates are also entitled to use the Dutch title of *ingenieur (ir)*.

2.6 Admissions

General and specific master program requirements are applicable to admissions. The specific requirements may be higher in terms of knowledge prerequisites, but may also provide more possibilities for entry for students from other related areas of specialization.

2.6.1 General admissions requirements

To be eligible for admission to any of the master programs, a Bachelor of Science degree comparable to a Bachelor of Science Degree in Computer Science is required. This degree must be of an equivalent academic level and approximate scientific content as the corresponding Dutch BSc degrees. In addition, sufficient proficiency in the English language is required.

2.6.2 Admissions with deficiencies

For admitted students from other universities there may be an urge for repairing deficiencies due to differences in programs. The admission committee will point out those so-called homologation courses to the students directly or via the study advisor.
Students coming from other disciplines at the three Dutch technical universities may be admissible after they followed a 30 credits deficiency program. The disciplines in question are mentioned in the “3TU-doorstroommatrix”, the corresponding deficiency program is constructed on an individual basis.

2.6.3 TU/e students in their Bachelor phase

Students from a Bachelor discipline that has an immediate admission to the intended Master study are admitted according to the so-called “zachte-knip” if they lack at most 20 credits of their Bachelor program. They are allowed to follow only the first year Master courses.

2.6.4 Foreign students

The applications of students with a foreign university BSc degree in Computer Science will be evaluated by the admissions committee, taking into account both the academic level of the degree and the subjects studied by the applicant. In some special cases, relevant work experience may also be considered. The level of the degree is determined by the NUFFIC (www.nuffic.nl).

2.6.5 Polytechnic graduates (HBO)

Students who have completed a polytechnic program in computer science are eligible to participate in the pre-master programs. Completion of the pre-master program gives access to the corresponding master program. In chapter 5 further details about admission for HBO students and the premaster program can be found.

2.6.6 Admissions procedure

The procedure to be followed depends on your particular situation. Detailed information on the application procedure can be found on the site of the Education and Student Service Center of the TU/e, http://w3.win.tue.nl/en/student/international_student_affairs.
Foreign students must be aware that the admissions procedure, including visa application and other formalities, may take a while.

2.7 Studying abroad

In case a bachelor student wants to study abroad as part of the CSE program several options are available for students with a Dutch Bachelor diploma:

- Take subjects at a foreign university
- Do an internship abroad
- Do the graduation project abroad

Consult the study advisor for programmatic issues. For organizational issues the international affairs coordinator can be helpful. Her name is E. van den Hurk bc., Room HG 6.46, International.office.win@tue.nl.

One has to deal with the organizational aspects oneself. The Education and Student Service desk has a handy checklist; it can be found on http://w3.tue.nl/en/services/stu/.Information on scholarships can also be found at www.beursopener.nl.

2.8 Honors track

The department offers an honors program in order to challenge the best students for excellence and to stimulate them to take part in research during their studies and thereafter (in PhD or PDEng programs).
The program consists of two extra curricular honors internships (6 ects each), participation in ongoing research in close cooperation with the senior staff and participation in activities of the research schools. The program is intended for the best first year master students that act on a cum laude level.

2.9 Internal quality assurance

After each semester the individual courses as well as the program are evaluated by the programmanager and the study program committee. Based on this this evaluation follow-up actions for improvement are defined.

Input for the evaluation sessions are statistical data on the examination results, and the aggregated results from the semester questionnaires for students. It is of vital importance that students cooperate in this respect since only questionnaires with a sufficient number of respondents are taken into consideration.

Apart from that, the examinations committee periodically carries out an investigation, in particular on the quality of the graduation projects and the quality of (partial) interim examinations.

The opinion of students on the quality of their graduation project and process is gathered by means of a graduation questionnaire, which is filled in after the assessment of the graduation project. These are collected and aggregated once a year. The results are discussed both in the study program committee and examinations committee.

2.10 After graduation

As an MSc graduate in Computer Science and Engineering one is optimally prepared for a broad range of ICT related jobs.
However, one might consider to qualify oneself further for special jobs like system or software architect of for an academic career. In this case the department of Mathematics and Computer Science offers the following opportunities.

2.10.1 Software Technology PDEng degree program

The Professional Doctorate in Engineering (PDEng) degree program in Software Technology is provided in the context of the 3TU School for The Professional Doctorate in Engineering (PDEng) degree program in Software Technology is provided in the context of the 3TU School for Technological Design, the Stan Ackermans Institute.

It is an accredited and challenging two-year doctorate-level engineering degree program during which its trainees focus on strengthening their technical and non-technical competences related to the effective and efficient design and development of software-intensive systems, such as real-time embedded systems, in an industrial setting. The emphasis is on large-scale project-based design and development of this kind of software.

The various parts of the PDEng degree program aid to develop the capability of individuals to work within a professional context. It advocates a scientific research based approach to solving problems, a systematic way of collecting evidence and a critical, reflective, and independent mind for the analysis and interpretation of evidence.

It adds an additional dimension to a full MSc. program by extending it and integrating it with new elements. The emphasis is on developing and strengthening (exercising) the competencies necessary for finding technical solutions. For finding such solutions an effective collaboration with representatives of different domains in inevitable and this is practiced during the program. During the program the PDEng trainees focus on *systems architecting* and *designing software* for *software-intensive systems* in *multiple application domains* for the *High Tech Industry*.

After successfully completing all requirements, trainees are awarded a Professional Doctorate in Engineering degree.
More information can be found on: http://wwwooti.win.tue.nl

2.10.2 PhD programs

When pursuing an academic career, the first step is to obtain a doctorate. A PhD program is an individual four year program, dedicated to sharpen your research skills. Doctoral candidates are employed by the TU/e and fulfill an important function at the university: they contribute to the reputation and continuity of the research work.

Within the department various research groups work on challenging problems, some of very theoretical nature, others more applied. Within the CSE program one has the opportunity to nose about in various groups. An important step towards a research career can be the graduation project. It is carried out under the supervision of one of the expertise groups, the subject of which is your first specialization. Your supervisor might be helpful in finding an appropriate PhD position, either within the Eindhoven University of Technology, or somewhere else.

Also, an overview of available PhD positions within the university can be found on: http://w3.tue.nl/en/services/dpo/.

3. master program specifics

3. Master Program Specifics

The CSE master program exists, informally, in two variants. One goes under the generic name CSE and is considered to be the main program. The other is IST (Information Security Technology), a so-called special master track. IST is offered by the Kerckhoffs Institute, a joint initiative of the Eindhoven University of Technology, the Radboud University in Nijmegen and the University Twente, and is meant to become an independent master program in the future. These two variants will be addressed separately below.

3.1 Computer Science and Engineering

The master program in Computer Science and Engineering (CSE) at TU/e is a challenging two-year program. It rests on a sound theoretical foundation with an emphasis on design in general, and on the design of quality software in particular. As a graduate, you will have developed a scientific attitude and an engineering approach to the general field of Computer Science. You will be able to play a leading role in the development of the field, either in scientific research, in industry, commerce or governmental organizations. The focus is on the design of efficient and reliable software systems. The complexity of these systems is the main (and intriguing) problem, especially in the common case of several communicating systems that are working in parallel. In order to construct dependable protocols for the behavior of such systems, you need knowledge of algorithms, performance, hardware, methods of design and documentation, and an insight into the variability and maintainability of these protocols.

3.1.1 Curriculum

As mentioned in section 2.3, the curriculum is divided into three parts. The mandatory part of the curriculum is 30 credit points and consists of a choice of five courses out of a collection of eight core courses that give an indication of the areas of expertise:

Quarter	Code	Study component	Credits
First year			
Core courses			**25**
1-2	2IF25	Formal methods	5
1-2	2IL45	Advanced algorithms	5
1-2	2IN26	Real-time embedded systems	5
1-2	2IS15	Generic language technology	5
1-2	2IV35	Visualization	5
1-2	2IW26	System validation	5
3-4	2ID45	Advanced databases	5
3-4	2II55	Business process management systems	5
1-4		**Elective courses**	**35**

Additionally CSE students should follow a seminar to prepare for their master project. There will be a seminar for each chair in which typical research issues for that field will be treated.

Quarter	Code	Study component	Credits
Second year			
Seminar			
1-2	2IF95	Seminar formal methods	5
1-2	2II96	Seminar architecture of information systems	5
1-2	2ID95	Seminar databases and hypermedia	5
1-2	2IL95	Seminar algorithms	5
1-2	2IN95	Seminar systems architecture and networking	5
1-2	2IS95	Seminar software engineering and technology	5
1-2	2IV95	Seminar visualization	5
1-2	2IW95	Seminar design and analysis of systems	5
3-4	2IC95	Seminar security	5
1-2		**Elective courses**	**25**
3-4	2IM91	**Master project**	30

3.1.2 Electives

The elective part of the curriculum amounts to 60 credits and it consists mainly of courses. In general, courses can be chosen freely from the list provided in section 3.3 and from curricular courses in the other computer science programs. Some courses with a maximum of 18 credits, may be prescribed as homologation courses to make up for deficiencies in former education. Other courses may only be selected after approval by the examinations committee in advance (you may consult the study advisor). In some cases an internship of 15 credits may be part of the electives. In section 3.3.1 the details of this possibility are discussed.

3.1.3 Master project

The Master project is a project of 30 credit points (half a year) and it can be completed in any of the areas of expertise in the CS-division, as long as a CS staff member is supervising it. The CS division has eight areas of expertise, each offering specialization courses. Details on the interests in the areas of expertise can be found in chapter 4.
In general the master project has to be finished within 9 months from the start. The exam committee may allow for an additional 3 months period. More information you find on site http://w3.win.tue.nl/en/programs/masters_education/students_computer_science/cse/.

It is strongly advised to deliver a midterm presentation.

The preparation that is needed for a successful master project in one of these specializations can be achieved through careful elective selections and following the appropriate seminar. In order to compose a well-balanced program that provides adequate prerequisites for the final project, it is advisable to first choose and consult a project supervisor in the chair of your interest before scheduling elective courses. You may also want to consult the study advisor. For the requirements to be met by students for master project work, please refer to section 3.4 on planning and to the graduation regulations, to be found on site http://w3.win.tue.nl/en/programs/masters_education/students_computer_science/cse/.

3.1.4 Further details

- The program director graduate school is prof.dr. M.T. de Berg, e-mail: m.t.d.berg@tue.nl
- The vice director is dr. M.A. Westenberg, e-mail: m.a.westenberg@tue.nl
- Programmanager CSE is dr. A. Serebrenik, e-mail: a.serebrenik@tue.nl
- Programmanager IST is prof.dr. S. Etalle, e-mail s.etalle@tue.nl
- The study advisor is dr. J.P. Veltkamp, e-mail: j.p.veltkamp@tue.nl.

For more information consult the CSE webpage www.win.tue.nl/masterprogramguide/cse.

3.2 Information Security Technology

A Master of Science in Information Security Technology (IST) is an academic expert in the area of digital communication in general, and in information security technology in particular. Information security technology protects data that are stored, transmitted, accessed or modified against all kinds of threats. This can vary from unauthorized access to malicious manipulations. Information security technology is essential for secure communication and data protection in many situations.

The IST program is a joint master program between three Dutch universities: Eindhoven University of Technology (TU/e), Radboud University in Nijmegen (RU), and University of Twente (UT). These three universities have joint their forces with respect to security education in the Kerckhoffs Institute, see www.kerckhoffs-institute.org.

Each of the mandatory and special elective courses is taught at only one of these three universities. This implies that students have to travel to other sites for part of their education. The program is set up in such a way that averaged over the two years of their master's studies students will have to travel one day per week to another university.

A Master of Science in Information Security Technology can become involved in cryptographic primitives, security protocols, data storage, communication, or information security management. Additionally, he or she can act as internal or external consultant, regarding the security of information systems and networks, or regarding the security policy of an organization. A Master of Science in Information Security Technology can enter a job in the following institutions: research laboratories and academic institutes (both for theoretical and applied work); applied R&D in industry; the financial world; governmental agencies; consultancy agencies (all with respect to security in the area of information systems and relevant policymaking).

3.2.1 Curriculum

The curriculum consists of both computer science courses and mathematics courses. Below is an overview of the program.

Quarter	Code	Study component	Credits	Location
First year				
1-2	2IF05	Introduction to computer security	6	Twente
1-2	2WC12	Cryptography 1	6	Eindhoven
3-4	2IF02	Verification of security protocols	6	Eindhoven
3-4	2IF06	Software security	6	Nijmegen
		Elective courses	**36**	
Second year				
1-2	2IF07	Security in organizations	6	Nijmegen
1-2	2IF08	Network security	6	Twente
1-2		**Elective courses**	**18**	
3-4	2IM91/ 2H016	**Master project ***	**30**	

*) In case the master project is done within the Mathematics Division the code is 2H016.

3.2.2 Electives for IST

In this section a collection of courses at MSc-level is outlined. Items on this list can be selected as electives towards degree completion for the master specialization IST. Also the general CSE-electives (see section 4.3) can be selected, but at least three elective courses must be chosen from the list of electives for IST:

Quarter	Code	Study component	Credits	Location
First year				
1-2	2IF09	Biometric recognition	6	Twente
1-2	2IF16	Security of Information systems	6	Twente
1-2	2WC16	Linux kernel and OS security	6	Eindhoven
3-4	2IF03	Seminar information security technology	6	Eindhoven
3-4	2IF13	Privacy seminar	6	Nijmegen
3-4	2WC13	Cryptography 2	6	Eindhoven
Second year				
1-2	2IF12	Law in Cyberspace	6	Nijmegen
1-2	2IF14	Hardware and operating system security	6	Nijmegen
1-2	2IF15	Secure data management	6	Twente

Otherwise, the same rules apply as outlined in section 3.1.2 .

3.2.3 Master project

The master project can be completed under supervision of the staff of any of the groups in the department, provided the program and the subject are chosen in agreement with the programmanager.
For requirements with respect to the start of the master project, please refer to section 4.4 on planning and to the graduation regulations, to be found on site www.win.tue.nl/masterprogramguide/regulations/.

3.2.4 Further details

- The programmanager is prof. dr. S. Etalle, e-mail: s.etalle@tue.nl.
- Students with a Bachelor's degree in Computer Science or Mathematics from another university or with a different background will have to submit their curriculum to the admissions committee for evaluation and approval. Very likely, these students will have to go through a special homologation phase that takes place during the first term of the program.
- www.kerckhoffs-institute.org

3.3 Electives

In this section a collection of courses at MSc-level is outlined. Items on this list can be selected as electives towards degree completion for all master specializations, as far as they were not yet mandatory for the specialization in question. For these electives it is not necessary to request approval to the Examinations Committee in advance.

Quartile	Code	Study component	Credits
First and second year			
1	2II65	Metamodeling and interoperability	5
1-2	2ID25	Information retrieval	5
1-2	2ID55	Adaptive systems	5
1-2	2IF25	Formal methods	5
1-2	2IF35	Formal modeling in cell biology	5
1-2	2II35	Web information systems	5
1-2	2II45	Architecture of distributed systems	5
1-2	2II70	Constraint programming	5
1-2	2IL45	Advanced algorithms	5
1-2	2IN26	Real-time systems	5
1-2	2IS15	Generic language technology	5
1-2	2IS25	Distributed trust management	5
1-2	2IV05	Additional component computer graphics	5
1-2	2IV35	Visualization	5
1-2	2IW26	System validation	5
1-2	2IW55	Algorithms for model checking	5
3-4	0T400	Academic skills in English 1	3
3-4	2IC35	Physical aspects of computer security	5
3-4	2ID35	Database technology	5
3-4	2ID45	Advanced databases	5
3-4	2IF45	Process algebra	5
3-4	2IF65	Proving with computer assistance	5
3-4	2IF75	Quantitative formal methods	5
3-4	2II55	Business process management systems	5
3-4	2II75	Business process simulation	5
3-4	2IL35	I/O efficient algorithms	5
3-4	2IL55	Geometric algorithms	5
3-4	2IN35	VLSI programming	5
3-4	2IP45	Software project management	5
3-4	2IS35	Verification of security protocols	5
3-4	2IS55	Software evolution	5
3-4	2IV15	Simulation in computer graphics	5
3-4	2IV55	Interactive virtual environments	5
3-4	2IW15	Automated reasoning	5
3-4	2IW45	Programming by calculation	5

Quarter	Code	Study component	Credits
Capita selecta			
1-2	2IS99	Capita selecta software engineering and technology	5
	2IC99	Capita selecta security	5
	2ID99	Capita selecta databases and hypermedia	5
	2IF99	Capita selecta formal methods	5
	2II99	Capita selecta architecture of information systems	5
	2IL99	Capita selecta algorithms	5
	2IN99	Capita selecta systems architecture and networking	5
	2IV99	Capita selecta visualization	5
	2IW99	Capita selecta design and analysis of systems	5
	2IM02	**Internship**	**15**

Capita selecta courses are occasional educational elements, often with a research flavor. They may be experimental courses, a lecture series given by a visitor, or a special individual assignment as a preparation on future research. Attendance or eligibility is decided on by the lecturer; students do not have a “right” to do these courses, but they may be granted the possibility.

Other electives may be chosen provided that they are approved by the Examinations Committee in advance. Please consult the study advisor dr. J.P. Veltkamp, HG 6.38, telephone (040)(247) 2763.

3.3.1 Internship

In some cases an internship may be a valuable addition to the program. It should enhance practical experience and provide deepening of knowledge. An internship takes 15 credit points as part of the electives and should contribute to the specialization. In general, internships will only be allowed for students that followed a bachelor program at the TU/e, but exceptions are possible. Requests for internships accompanied by convincing arguments explaining the reasons why the intended internship fits into the program are to be sent to the educational director or the study advisor.

3.3.2 Note

The second year courses, seminars and capita selecta are only available for students that are fully admitted, so they are not available for students that do not yet have their BSc diploma or students that did not yet complete the premaster. Other students that have deficiencies (e.g. uncompleted homologation courses) may also be refused to do some second year courses.

3.4 Planning

The master program is a short program. In only two years, you must meet several conditions and obligations and advance planning may help to meet them in time, so that the study is not unnecessarily prolonged.

A reverse inventory gives the best view on the schedule to be kept. During the master project, you should be able to spend full time and concentration on your project. In practice, however, it turns out to be rather difficult to plan curricular activities and, especially, their success. Therefore, we leave room for at most two courses of in total at most ten credit points to be finished during the master project period. However, be aware that you are not allowed to finish your project before you completed all your courses.

The start of your master project is marked by submitting a completed graduation plan containing the necessary information on the project (name, place, period, supervisor, company and so on) and stating the fact that you have completed your curricular part of the program (except for courses of at most ten credits). The form must be accompanied by a project description and signed by you, your supervisor, the head of the relevant chair and the study advisor. Prior to this step, you need:

- an approved program. The Examinations Committee must approve your program consisting of the mandatory courses and your choice of the electives. In order to obtain this approval you construct a program, possibly with the help of the study advisor, fill out the program form, have it signed by yourself and the supervisor of your choice and hand it in at the student administration office (HG 6.45).
- a supervisor. After a while you will probably have a clear picture of the academic direction you want to pursue in your studies. If not, you may want to talk to several staff members, along with the study advisor. In the chair for your subject, there are people that you may want to be involved with as you complete the master project. You should discuss and try to reach agreement with these people on the prerequisites and the curricular program that is needed to fruitfully complete the project.

As a rule of thumb, you should start your search for a supervisor and the construction of your individual program not later than at the end of the first year. This is because some room for the special needs for the specific project should be left in the second year. The study advisor may be helpful to you in this regard. Please refer to the graduation regulations, to be found at site http://w3.win.tue.nl/en/education/regulations/.
The necessary forms can be obtained from the Student Administration or at the aforementioned site.

3.5 Double degree program CSE and SEC

The qualification to teach computer science to senior secondary pupils is coupled to the 3TU program Science Education and Communication (SEC). This program encompasses 120 credits. In Eindhoven it is offered by the Eindhoven School of Education (ESoE). In the Education track of the SEC program a student specializes in one of four disciplines: maths, physics, chemistry or computer science. Please note that the SEC program is completely lectured in Dutch!
BSc graduates in computer science are directly admitted to the SEC-program. So are MSc graduates from a computer science oriented program; their SEC-program is reduced to 60 credits because of exemptions. For this last category an even shorter route is available by taking the double degree program, which amounts up to 150 credits.
Enrollment is required for both master programs (one main enrollment and a second enrollment). Certificates will be granted after completion of the **whole** program.

3.5.1 Double degree curriculum

30 ects	Mandatory part of CSE (5 core courses plus a seminar)
30 ects	Electives CSE
10 ects	EMC11 Didactics of computer science 1 (4 ects)
	EMC12 Didactics of computer science 2 (3 ects)
	EMC13 Didactics of computer science 3 (3 ects)
20 ects	EME.. Theory of practice 1 (10 ects)
	EME.. Theory of practice 2 (10 ects)
20 ects	EME09 Orientation (5 ects)
	EME12 Theory of education 1 (3 ects)
	EME13 Theory of education 2 (3 ects)
	EME14 Theory of education 3 (2 ects)
	EME10 Bèta didactics 1 (3 ects)
	EME11 Bèta didactics 2 (4 ects)
30 ects	Graduation project CSE
10 ects	Graduation project SEC *
150 ects	**Total**

*) The graduation project of SEC has to be carried out after the CSE graduation project.

4. specializations

4. Specializations

In this chapter, you can read about the different specialization options within the CS Division. Details on non-divisional specialization options are available through the study advisor.
For every chair the field of interest is indicated and courses are mentioned that contain relevant material for students that wish to participate in the research in that area. The courses are not meant to be obligatory for candidate graduates, but they give an impression of the predispositions of the staff.
The contact person mentioned may give you additional information on the possibilities of a graduation project in that chair.

4.1 Algorithms

Contact person: Prof.dr. M.T. de Berg

The creation, storage, analysis and manipulation of spatial data plays a central role in robotics, computer graphics, geographical information systems, and other areas of computer science. In all these areas, there are many challenging algorithmic questions. For example, a typical problem in robotics is to compute efficient routes for a robot moving through a factory building while avoiding all obstacles in its way. A typical problem in geographic information systems could be to find a good location of a new airfield, say the location such that the region in a 20-mile radius around it is the least populated. Such problems form the focus of this chair we study techniques and concepts for the design and analysis of efficient algorithms and data structures, with emphasis on algorithms for spatial data. Typical master projects are either experimental or theoretical in nature, depending on the interests of the student.

Relevant courses for the ALG chair are:

- I/O Efficient Algorithms (2IL35)
- Advanced algorithms (2IL45),
- Geometric algorithms (2IL55),
- Seminar algorithms (2IL95),
- Capita selecta algorithms (2IL99).

Other relevant courses:

- Additional component computer graphics (2IV05),
- Visualization (2IV35),
- Interactive virtual environments (2IV55).

4.2 Formal methods

Contact person: dr. E.P. de Vink

Research in Formal Methods is a systematic and scientific study of issues in Computer Science, based on solid mathematical principles. The area of Formal Methods concerns fundamental research and considers systems and constructions used in Computer Science. These constructions are described exactly in a formal syntax and are supplied with formal semantics, whenever appropriate. Formal Methods increase understanding of systems, increase clarity of description and help solve problems and remove errors. The use of Formal Methods increases dependability and usability of constructions and systems in Computer Science. Formal Methods are not studied in isolation, but for practical application. Thus, choice of research topics is inspired by the practice of Computer Science. To support application, existing tools are used and new tools are developed.

Based on our expertise and the benefits expected in application, we focus on the following specific areas:

- Process algebra (functional correctness and performance analysis),
- Assertional methods,
- Formal methods in life sciences,
- Stochastic systems,
- Hybrid systems.

Relevant courses for the FM chair are:

- Formal methods (2IF25),
- Formal modeling in cell biology (2IF35),
- Process algebra (2IF45),
- Proving with computer assistance (2IF65),
- Quantitative formal methods (2IF75)
- Automated reasoning (2IW15),
- System validation (2IW26),
- Seminar formal methods (2IF95),
- Capita selecta formal methods (2IF99).

4.3 Information Systems

The specialization profile Information Systems covers two subareas:

- Architecture of Information Systems (AIS). Contact person: N. Sidorova
- Databases and Hypermedia (DH). Contact person: T. Calders

4.3.1 Architecture of Information Systems

The Architecture of Information Systems (AIS) research group investigates *methods, techniques and tools for the design and analysis of Process-Aware Information Systems* (PAIS), i.e., systems that support business processes (workflows) inside and between organizations. AIS is not only interested in these information systems and their architecture, but also model and analyze the business processes and organizations they support. The group aims at results that are highly original and applicable in real-life situations. The main three research lines of AIS are:

- **Process Modeling and Analysis**. Models are commonly used to answer questions related to correctness and performance. One of the main goals here is to further improve *verification techniques to check various properties such as soundness, data/resource soundness, accordance, controllability, and selected temporal properties*. Pattern-based approaches are used for *correctness-by-design*. Another goal is to develop *innovative simulation approaches* that better reflect reality and that can be used in an operational setting while using process mining results.
- **Process Mining**. Process mining techniques are used to extract process-related information from event logs, e.g., to automatically discover models, check conformance, and augment existing models with additional insights extracted from some event log. The goals are to significantly *improve the state-of-the-art in process discovery*, to *advance the state-of-the-art in conformance checking*, and to *predict problems*, i.e., provide warnings based on historic information (e.g., a case will be late or an error is likely to occur).
- **PAIS Technology**. PAISs are used to *manage and execute operational processes involving people, applications, and/or information sources*. Examples are WFM (Workflow Management), BPM (Business Process Management), and ERP (Enterprise Resource Planning) systems. Increasingly, these systems are driven by models and produce high-quality event logs. We are interested in the artifacts used and produced by these systems (i.e., models and logs) as these are essential for testing the techniques developed in the two other research lines. For example, it is interesting to convert and verify process models expressed in some particular industry language. The same holds of course for event logs. *Service-orientation* plays an important role here and this new architectural style poses new research questions.

4.3.2 Databases and Hypermedia

The focus of DH is on the study of concepts and technologies that are used to store, access and manage information. Information often comes from several sources that each contains a wealth of information of which only a small subset is of interest to any particular user or user group.

- Database systems are needed to store, maintain, and efficiently query the data; data can come in different flavors from unstructured text-data, semi-structured XML data to structured databases;
- Datamining and information retrieval automate the extraction of information and knowledge from large amounts of data; often so much data is collected that manual analysis is no longer possible. Data mining and information retrieval assist data analysts in locating relevant information and patterns in the data.
- Web-information systems make these databases accessible over the Web; and
- Adaptation, or automatic personalization, must ensure that each user is guided (automatically) to the information that is relevant to him or her, resulting in Adaptive Hypermedia systems. Adaptive Hypermedia is studied at the conceptual and the practical level: the former is done through the study of Adaptive Hypermedia Reference Models, the latter through the development of the Adaptive Hypermedia Architecture (currently named AHA!), a general-purpose web-based adaptive hypermedia system.

The DH group focuses research in these overlapping domains aimed at the efficient disclosure of large data repositories in a user-friendly manner.

Relevant courses for the IS areas of expertise are:
- IT-governance (1BM65),
- Advanced databases (2ID45),
- Information retrieval (2ID25),
- Database technology (2ID35),
- Adaptive systems (2ID55),
- Capita selecta databases and hypermedia (2ID99),
- Web information systems (2II35),
- Architecture of distributed systems (2II45),
- Business process management systems (2II55),
- Metamodeling and interoperability (2II65),
- Contraint programming (2II70),
- Business process simulation (2II75),
- Seminar databases and hypermedia (2ID95),
- Seminar architecture of information systems (2II96),
- Capita selecta architecture

4.4 Design and Analysis of Systems

Contact person: prof.dr.ir. J.F. Groote

The focus of the chair OAS (*Ontwerp en Analyse van Systemen*) is on modeling and verifying behavior of systems and programs. Behavior must be understood as all possible actions that a system can consecutively perform during its lifetime.
Computer-based systems are so complex, that it is impossible to program them without understanding how the different software components communicate, and what the responsibilities of these parts are. By modeling the behavior, these responsibilities are made explicit. Due to the complexity of the matter at hand, it is also non-trivial to get these behavioral models correct. For this purpose we use analysis techniques. Primarily, these are used to find flaws in the model, and ultimately these are employed to show that the modeled behavior satisfies all the requirements. For instance, a data communication protocol must not lose messages, and a firewall should under no circumstance let an intruder pass.

With current modeling techniques it is no problem to model the communication patterns of even the most complex systems. Using modal formulas most requirements can be formulated in a formal, precise way. Using one of the many existing process equivalences, it is very well possible to state the behavioral equivalence between implementations and specifications. So, in general, it is not really problematic (but sometimes hard) to formulate the properties that a system ought to have.

The current technological bottleneck is our capability to prove that a requirement holds for a given model (the model checking problem) or that two processes are actually equivalent (the equivalence checking problem).
The major research activity of this group is to increase the strength of the analysis tools.
The core problem of the analysis of behavior is the state space explosion problem. There are so many states in which a system can end up, that it is generally impossible to explore these all individually. For this purpose, we must use so-called symbolic techniques to enable the verification. These techniques come from the realm of automatic reasoning, term rewriting and computer assisted theorem checking.

Also, state space reduction techniques (abstract interpretation, confluence checking) are relevant to reduce the problem size.
Visualization turns out to be a relevant tool, to detect unforeseen problems and to increase insight in the behavior. Knowledge of algorithms, including I/O-efficient algorithms is relevant, to construct analysis tools capable of dealing with huge state spaces.

In order to investigate how effective our analysis techniques are, we are constantly assessing their practical use. For instance, the OAS group is involved in the standardization of several protocol standards (e.g. firewire).
Our role is to assist the standardization process by showing where the protocol does not conform to its intention. With several of the embedded system industries around Eindhoven, we have a similar relationship: we design, model and analyze (parts of) the behavior of the equipment they are building.

Relevant courses for the OAS chair are:
- Automated reasoning (2IW15),
- System validation (2IW26),
- Programming by calculation (2IW45),
- Algorithms for model checking (2IW55),
- Seminar design and analysis of systems (2IW95),
- Capita selecta design and analysis of systems (2IW99),
- Formal methods (2IF25),
- Formal modelling in cell biology (2IF35),
- Process algebra (2IF45),
- Proving with computer assistance (2IF65),
- Architecture of distributed systems (2II45),
- Advanced algorithms (2IL45),
- Generic language technology (2IS15),
- Visualization (2IV35)

4.5 System Architecture and Networks

Contact person: dr. R.H. Mak

Imagine just any electronic system that is not somehow networked with other systems. Found one? Must be a pretty boring system then, since one of the fascinating developments of the last years is that devices of all form factors and functionality become connected. In our group we study parallel and distributed systems with an emphasis on pervasive systems or, as we call it, Resource Constrained Networked Embedded Systems.

Relevant courses for the SAN chair are:
- Real-time embedded systems (2IN26),
- Architecture of distributed systems (2II45),
- VLSI programming (2IN35),
- Seminar systems architecture and networking (2IN95),
- Capita selecta systems architecture and networking (2IN99) (not always given).

Other relevant courses are:
- Adaptive systems (2ID55),
- Seminar security technology (2IC95),
- Distributed trust management (2IS25),
- Web information systems (2II35),
- Advanced algorithms (2IL45),
- Generic language technology (2IS15),
- System validation (2IW26).

Master thesis assignments are related to the research topics of SAN, which focus on distributed aspects of RCNES (middleware and networked services), on the platform (predictable and reliable resource management) and on efficient embedded computations (typical for signal processing). Research questions are, for example, how to build and manage applications composed from distributed services, and how to perform distributed resource management.

We pay a lot of attention to *quality aspects*, which include performance, predictability, dependability, programmability and security. A dominant issue in our work is therefore the *architecture* of these RCNES, in particular the software architecture, as this is where the quality aspects are addressed. We relate our work to application domains which we see as vehicles for our research. Example application domains include distributed media systems, wireless sensor networks, automotive electronics and, more recently, lighting. Much of this work is done in cooperation with industry through national and international projects. Have a look at our research page to see the projects we are involved in:
w3.win.tue.nl/nl/onderzoek/onderzoek_informatica/system_architecture_and_networking.

4.6 Software Engineering and Technology

Contact person: prof.dr. M.G.J. van den Brand

The software industry is facing two trends. First of all, the amount of software is exploding. Secondly, the quality of software is decreasing. These trends result in new research challenges. How to develop more high quality software in less time? How to guarantee the quality of the software? How to deal with the huge amount of existing software? The answers to these questions are not straightforward. A common theme in the answer to these questions is model driven software engineering. Models provide a higher level of abstraction and thus allow the specification of more functionality in less code. The models can also be used as starting point for simulation and verification. Finally, existing software can be analyzed and the underlying models can be extracted. The research focus of the research group SET is on model driven software development. The field of model driven software development is broad. In fact we specialize in two directions: the development of tooling to support the development of models in domain specific formalisms and the extraction of high level models given source code. Research on tooling for model driven software development includes the development of semantics of domain specific languages, semantics of model transformation formalisms, quality of model transformations and model versioning. The ultimate goal is to provide a tool set which provides high fidelity software generation.

The other side of the coin is the extraction of information from existing source code. Again this is a broad field. The success of research in this field depends on the flexibility of the tooling. The analysis of software should not be restricted to one programming language, but should be multi-lingual. Our expertise in generic language technology is crucial to be able to deal with multi-lingual software systems. In close cooperation with LaQuSo multi-lingual tooling for software analysis and visualization has been developed. The ultimate goal of this research is to extract models of existing source code at the right level of abstraction. These models can then be used for maintenance purposes, verification, and/or forward engineering.

A third research topic is the development of an integrated development environment to allow the development of software and proofs at the same time. The challenges in this type of research are flexibility and scalability. An environment which is too slow or tedious to use will never become a success. Our focus is to develop an environment where the software developer is supported by a collection of provers when developing the software. This research is closer to programming-in-the-small and is strongly related to the Eindhoven's way of software development, once promoted by E.W. Dijkstra.

Relevant courses for the SET chair are:
- Generic language technology (2IS15),
- Software evolution (2IS55),
- Architecture of distributed systems (2II45),
- Programming by calculation (2IW45),
- Seminar Software Engineering and Technology (2IS95),
- Formal methods (2IF25)

4.7 Visualization

Contact person: dr.ir. H. van de Wetering

The focus of this chair is on the development of new methods and techniques for interactive visualization in order to analyze and manipulate large datasets. One focus of the group is information visualization, which aims at giving insight in abstract data, such as tree structures, networks and multivariate data, for applications such as software engineering and DNA analysis. Other interests are visualization of flow fields and tensor fields, as well as visualization of mathematical objects.
In all these fields, aims are to develop new visual representations and interaction methods, as well as to develop new evaluation methods and obtain a better understanding of the visualization process itself.

Furthermore, in cooperation with the National Research Institute for Mathematics and Computer Science (CWI) desktop virtual reality systems are studied. Typical topics here are to develop methods for calibration, input - including 2D/3D combination input - and pattern matching and to build and evaluate applications.

Relevant courses for the VIS chair are:
- Visualization (2IV35),
- Geometric algorithms (2IL55),
- Additional component computer graphics (2IV05),
- Simulation in computer graphics (2IV15),
- Interactive virtual environments (2IV55),
- Seminar visualization (2IV95),
- Capita selecta visualization (2IV99).

Other relevant courses:
- Information Retrieval (2ID25).

4.8 Security

Contact person: prof.dr. S. Etalle

The interconnectivity and pervasiveness of computers and of embedded systems like PDAs and smart phones is not only determining new functionalities, but is also opening the way to increasingly sophisticated attacks. Indeed, in the last years the field of security has become one of the main focuses of computer science research around the globe. The newly established security group aims at contributing to a comprehensive framework for the engineering, the deployment and the maintenance of secure distributed systems, in which existing and new techniques are harmonized and integrated. The group focuses on distributed system security: a broad area that deals with the security of embedded systems as well as of the ICT infrastructures. Prominent subfields are: the specification and the enforcement of usage policies of critical systems, verification of security protocols, trust management.

The group cooperates actively with the Radboud University and the University of Twente in the Kerckhoffs security master.

Relevant courses for the SEC chair are:
- Seminar information security technology (2IF03),
- Verification of security protocols (2IF02),
- Distributed trust management (2IS25),
- Introduction to computer security (2IF05),
- Linux kernel and OS security (2WC16),
- Cryptography 1 (2WC12),
- Cryptography 2 (2WC13),
- Coding and crypto 1 (2WC09),
- Physical aspects of computer security (2IC35),
- Software evolution (2IS55).

5. pre-master program CSE

5. Pre-master program CSE

The pre-master program that a student with a completed polytechnic program of computer science has to follow consists of the following units of in total 30 credit points:

Quarter	Code	Program unit	Credits
Start in semester A			
1	2DL03	Basic mathematics	3
1	2DL06	Linear algebra	3
1-2	2IT05	Logic and set theory	6
1-2	2IT15	Automata and process theory	6
1-2*	2ID05	Datamodeling and databases	6
2	2DL04	Calculus A	3
2	2DL07	Statistics A	3
Start in semester B			
3	2DL03	Basic mathematics	3
3	2DL06	Linear algebra	3
3-4	2IT05	Logic and set theory	6
3-4	2IL05	Data structures	6
3	2IT16	Finite automata and processes	3
4	2IT19	Formal languages and decidability	3
4	2DL04	Calculus A	3
4	2DL07	Statistics A	3

*) This subject is taken in sem. A of academic year 2011-2012.

Those taking the pre-master program for polytechnic graduates are required to include some units of the bachelor program *Technische Informatica* as homologation units in the elective part of the master program:

Quarter	Code	Program unit	Credits
1	2IJ26	Algebra *	3
1-2	2IT25	Discrete structures *	6
Program unit missing in the pre-master program			**6**
1-2	2ID05	Datamodeling and databases	6
3-4	2IL05	Data structures	6

*) The students in the specialization IST include Discrete structures (2IT25). The regular students in the standard CSE program include Algebra (2IJ26).

Those taking the pre-master program for polytechnic graduates may be given permission to take part in some of the units of the master program. A necessary condition for permission is that the student has at least scored 15 credit points from the pre-master program.
Those taking an adapted or individually composed pre-master program in the bachelor program may be given permission to take part in some of the units of the master program, or may be allowed to follow altered or entirely different units from the master program.

The students that wish to take study components from the master program must submit a request to this effect as a contracting party to the TU/e. The form needs to be signed the pre-master coordinator or the study advisor.
If the request is granted, then the period of enrolment is set; this may be a maximum of one year on the condition that it is not longer than the enrolment of the student in the bachelor program.

The pre-master study advisor is dr. C.J. Bloo, HG 6.39, telephone number (040)(247)4496.

6. academic administration

6. Academic Administration

6.1 Academic administration of the department

The structure of the academic organization is based on the Academic Administration Structure Modernization Act (MUB), as implemented in the academic year 1997-1998. A student may contribute to the improvement of the academic organization as a member or advisor on the Department Board, the Study-program Committee or the Department Council. Participation in these organizations offers special privileges, such as facilities for oral instead of written exams or extra opportunities for taking examinations outside regular scheduling.

Important organizations:

- The Department Board (*Faculteitsbestuur*);
- The Programmanager (*Opleidingsdirecteur*);
- The Study-program Committee (*Opleidingscommissie*);
- The Examinations Committee (*Examencommissie*);
- The Department Council (*Faculteitsraad*);
- The CS Division and Professors (*Capaciteitsgroep en Hoogleraren*);
- The CS Division Board (*Capaciteitsgroepsbestuur*);
- The Department Office (*Faculteitsbureau*);
- The Student Council (*Studentenraad*).

6.1.1 Department Board of Mathematics and Computer Science

The Department Board appoints a programmanager for each master program. The programmanager is mandated to develop, organize and implement the master program. Although some authority is delegated to the programmanager, the Department Board retains final responsibility for each graduate program. This means that the programmanager must report to the Department Board. The Department Board establishes the education and examination regulations (OER) and the program budget, and oversees the implementation of the master program. The Department Board is comprised of four members: the dean and chairperson, two vice-dean and division chairs and the managing director. A student advisor also participates in the board meetings, as advisor. Other attendees at the board meetings are the policy advisors and the department secretary.

The current members of the Department Board are:
Dean: prof.dr. A.M. Cohen
Vice-deans: prof.dr. O. Boxma and vacancy
Managing director: R.M.A. van de Donk

6.1.2 Programmanager

Every year the programmanager outlines in the OER the academic program and policies, including the program structure and curriculum. She develops the program curriculum in close consultation with the teaching staff. The Study-program Committee advises the programmanager on long-term strategies and policies on academic principles and goals, and on the exit qualifications of the Master degree. The programmanager is in charge of the development and implementation of a quality management system. The Study-program Committee advises the programmanager on his curriculum and quality plans. In addition, the programmanager advises the Division Board on the academic program. Whenever necessary, she also advises the Division Board on quality improvement and performance of the academic staff.

The programmanager relies on the Department Office for administrative and managerial support. The Department Office also advises the programmanager on academic issues.
The programmanager for CSE is dr. A. Serebrenik.

6.1.3 Study-program Committee

The OCI (*Opleidingscommissie Informatica*) is the Study-program Committee for CSE (as well as for the BSc. Program Technische Informatica). The OCI is appointed by the Department Board.

The tasks of the OCI are:

- to advise the programmanager and the Department Board on issues relating to the OER;
- to annually evaluate the implementation of the OER:
- to advise on all issues relevant to the academic program.

6.1.4 Examinations Committee

The Department Board appoints department members to sit on the Examinations Committee. The Examinations Committee is responsible for the organization and coordination of exams and all ensuing activities. The Examinations Committee appoints all examiners in accordance with the Higher Education and Research Act (WHW), article 7.12.

The Examinations Committee establishes exam rules of conduct applicable to both students and examiners. These rules and regulations on proper behavior also stipulate disciplinary measurements and sanctions in case of violation.
Chair: Vice-dean Computer Science.
The Secretaryof the Examaninations Committee is dr. E.F. Kaasschieter.

6.1.5 Department Council

The Department Council is an important link in the decision making process. The Department Council exercises advisory and approval rights on issues concerning the responsibility areas of the Department Board. The Department Board must obtain the aforementioned approval on all decisions concerning adaptation or other amendments to the department regulations and the OER. The Department Council is comprised of 5 staff members and 6 elected student members.

The following currently sit on the Department Council:
Staff members: dr. C. Huizing, dr. A. Muntean, Msc. S. Dommers, ir. P.P. van Liesdonk and M.A.C.M. de Wert.
Student members: J.G. van der Pol, J. van Roosmalen, L.M. Scheepers, B.J.A. Laarhoven (chair) and I. van der Linden.

6.1.6 CS Division and professors

The general tasks of the CS Division are:
- to contribute to the preparation and implementation of the educational and exam programs;
- to contribute to the research programs;
- to contribute to the interdepartmental and inter-university education and research programs.

In addition, the CS Division Board aims to come to agreement with the programmanager on issues of quantity and quality of academic staff.

The tasks of the professors are:
- to develop their assigned research areas;
- to advise the programmanager on the contents of the educational program.

Division secretary:
M.M.W.G. van den Bosch-Zaat, telephone number (040)(247) 5010.

Visualization (VIS) Group:
Full professor: prof.dr.ir. J.J. van Wijk.
Part-time professor: prof.dr.ir. R. van Liere
Assistant and associate professors: dr.eng. A.C. Jalba, dr. M.A. Westenberg and dr.ir. H.M.M. van de Wetering.
VIS Group secretary:
M.M.W.G. van den Bosch-Zaat, telephone number (040)(247) 5010.

Algorithms (ALG) Group:
Full professor: prof.dr. M.T. de Berg.
Assistant and associate professors: dr. H.J. Haverkort, dr. B. Speckmann and dr. E. Mumford
ALG Group secretary:
M.V. Cheng, telephone number (040)(247) 5155.

Databases & Hypermedia (DH) Group:
Full professor: prof.dr. P.M.E. De Bra.
Part-time professors: prof.dr.ir. G.J.P.M. Houben
Assistant and associate professors: dr. T.G.K. Calders, dr. G.H.L. Fletcher and dr. M. Pechenizkiy.
Technical staff: dr.ir. H.M.W. Verbeek and dr. N. Stash.
DH Group secretary:
M.A. van Buul, telephone number (040)(247) 2602 and mw. C.W.J. van der Ligt, telephone number (040)(247) 2733.

Architecture of Information Systems (AIS) Group:
Full professors: prof.dr.ir. W.M.P. van der Aalst, prof.dr. K.M. van Hee and prof.dr.ir. W.P.M. Nuijten.
Assistant and associate professors: dr.ir. B.F. van Dongen, dr. N. Sidorova, dr. M. Voorhoeve, and dr. J.C.S.P. van der Woude.
Technical staff: dr.ir. H.M.W. Verbeek.
AIS Group secretary:
M.A. van Buul, telephone number (040)(247) 2602, mw. C.W.J. van der Ligt, telephone number (040)(247) 2733

Formal Methods (FM) Group:
Full professor: vacancy
Assistant and associate professors: dr. S. Andova, dr.ir. P.J.L. Cuijpers, dr. C. Huizing, dr. R. Kuiper,
dr. S.P. Luttik, dr. R.P. Nederpelt and dr. E.P. de Vink.
Technical staff: dr. E.J. Luit.
FM Group secretary:
M.V. Cheng, telephone number (040)(247) 5155.

Design and Analysis of Systems (OAS) Group:
Full professor: prof.dr.ir. J.F. Groote.
Part-time professor: prof.dr. J.H. Geuvers.
Assistant and associate professors: dr.ir. R.R. Hoogerwoord, dr. M.R. Mousavi, dr.ir. J.W. Wesselink, dr.ir. T.A.C. Willemse, and prof.dr. H. Zantema.
Technical staff: dr.ir. J.W. Wesselink.
OAS Group secretary:
M.M.W.G. van den Bosch-Zaat, Telephone number (040)(247) 5010.

Software Engineering and Technology (SET) Group:
Full professor: prof.dr. M.G.J. van den Brand.
Assistant and associate professors: dr.ir. M.G.J. Franssen, dr.ir. C. Hemerik, dr. A. Serebrenik, dr.ir. T. Verhoeff, dr. L.J.A.M. Somers and dr.ir. G. Zwaan.
Technical staff: ir. E.T.J. Scheffers.
SET Group secretary:
C.C. van Gils, telephone number (040)(247) 5145.

System Architecture and Networking (SAN) Group:
Professor: prof.dr. J.J. Lukkien.
Part-time professor: prof.dr.ir. C.H. van Berkel and prof. dr. A. Liotta
Assistant and associate professors: dr.ir. R.J. Bril, dr. R.H. Mak, dr. T. Ozcelebi, dr. D. Jarnikov, dr. S. Chen and dr. J.P. Veltkamp.
Technical staff: dr.ir. P.H.F.M. Verhoeven.
SAN Group secretary:
A. Gouma, telephone number (040)(247) 8309.

Security (SEC) Group:
Professor: prof.dr. S. Etalle
Part-time professor: prof.dr. M. Petrovic
Assistant and associate professors: dr. J.L. den Hartog and dr. B. Skoric
SEC Group secretary:
J.H.J.M. Matthijsse-van Geenen, telephone number (040)(247) 2853.
Reseacher: dr. N. Zannone

6.1.7 Department Office

The Department Board delegates day-to-day operations to the Department Office. The managing director heads the Department Office, which is sub-divided into six offices:

- Human Resource Management (HRM) Office,
- Financial Services Office,
- Computer Services Office (BCF),
- Management Support Office,
- Education Office,
- Public Relations.

The managing director of the Department Office is R.M.A. Van de Donk

The following are members of the staff of the Department Office:

Department Secretarial Services:
Head: M.P.M. de Faber.
Secretarial assistant: P.C.J. Gudden-van den Boomen, telephone number (040)(247) 2750.
General and janitorial services: J.W. Schellekens.

HRM Office:
Head: P.J. Evers b.c.
Staff: J. Kamperman, C.M. van Dam, and L.G. van Kollenburg-Walraet.

Financial Services Office:
Head: P.C.P. Geenen
Staff: J. den Braven bc. F.J.J. Haassen-Kok, H. de Morrée and P.H.V. Benckhuijsen

Computer Services Office:
Head: dr. P.J.E.M. Coenen
Staff: R.L.M. Beckers, S. Hoop, V.B. Huijgen, and J.P.H. Hunnekens.

Management Support Office:
Policy advisor Mathematics: ir. H.J.M. Wijers.
Policy advisor Computer Science: dr. D.M. de Haan.
Policy advisor Education: dr. E.F. Kaasschieter.

Study-program committee:
Head student Administration and International office: E. van den Hurk
Staff: J. Berger-van der Aalst, J.M.L.G. Sanders, and M.J.C.P. de Wit-van Geenen.

Study advisors: dr. C.J. Bloo and dr. J.P. Veltkamp.
Secretarial services: G. van der Linden-Cocu (CS) and C. Welten-Verhulst (Math).
Educationalist: dr.drs. J. C. Perrenet.

Public Relations:
Head: drs. J.M.F. Horvath-Notten.
Staff: Y.H.M. Houben and I.M.J. van Uden

6.1.8 Student Council

The Student Council's (StudentenRaad, SR) main goal is to help solve problems in the educational process, such as problems with examinations, time tables or professors.
The SR also mediates in cases where individual students encounter problems and it serves as a first information point for students who do not know who to go to if they have a question; in many cases the SR can refer students to the right place. Students with complaints or questions can reach the SR in the following ways

- During one of the biweekly meetings. For the most recent meeting schedule, please refer to www.studentenraad.org;
- By e-mail: sr@win.tue.nl or klachten@gewis.nl;
- By contacting the educational commissioner of GEWIS: oc@gewis.nl

Finally, the SR attempts to stimulate and facilitate contact among student members of the study program committee (OCI, OCW, OCBIS and OCES), the Faculty Council (FR), University Council (UR) and the Student Advisory Body (SAO) and to discuss the items on the agendas of each of these bodies. This is why members of these bodies are always encouraged to be present at SR meetings.

6.2 Facilities

6.2.1 Buildings

The department of Mathematics and Computer Science is located at the main building (HG) in floors 5 through 10. Regulations on access to university buildings are described in the departmental chapter of the student statutes and on the use of computer rooms are outlined on the website at www.win.tue.nl/masterprogramguide/regulations

For oral English explanation of these regulations, contact the Computer Services Office in room HG 8.73, telephone number (040)(247) 2802 or e-mail wshelp@win.tue.nl.

6.2.2 Lecture rooms, halls and other instruction facilities

The department uses lecture rooms within the whole university.
Lecture rooms and halls are managed at institutional level by mw. M. de Voogd, Auditorium 2.08, telephone number (040)(247) 2645. Reservations of the meeting and instruction rooms HG 5.95, 6.01, 6.05, 6.05a, 6.29, 8.39 and 8.61 can be arranged through the department student administration, telephone number (040)(247) 2379/8343.
To reserve the OGO and SEP rooms on floor 10 you can contact our scheduling coordinator e.v.d.hurk@tue.nl.

6.2.3 Library services

Library services are provided for all department employees and students. The library collection reflects the departmental scientific specialization in research and education. Opening times are Monday through Friday from 9:00 to 17:00. The department library is located in room HG 6.47. Students also have free access to the central library and all other departmental libraries.

Literature search:
In addition to its own search catalog VUBIS, the library also offers online bibliographical searching facilities.

Inquiries:
For further information, please contact the faculty liaison manager ir. E.J.M. Jacobs, or the other library staff members, M.G.J.M. Vringer, D. Pelsmaeker and N. van der Ham reachable at telephone number (040)(247) 2766 or e-mail wiskeninf.bib@tue.nl.
Additional information on the library of the TU/e, circulating regulations etc. can be found at the web pages of the library: www.tue.nl/bib.

6.2.4 Sale of study materials

Study material can be bought at the (lecture) notes warehouse subdivision Notes Sale (*"Dictatenverkoop"*). Daily opening hours are from 9:00 to 15:00. The warehouse is closed during introduction week. Inquiries can be made at: HG -1.42, telephone number (040)(247) 2446. For book sales at discount prices, please refer to section 6.3.

6.2.5 Computer Services Office

The Computer service office (BCF) is part of the department office.
BCF is located in HG 8.73. The BCF-helpdesk is open on working days from 9.00 until 17.00 hrs, tel. (040) (247) 2802, e-mail: wshelp@win.tue.nl,
Website: www.win.tue.nl/bcf

The tasks of the Computer Service Office (BCF) are:
- to provide computer facilities;
- to provide user support;
- to administer student accounts on the student server "svstud", a Linux-server for the students of the department;
- and to manage the use of computer rooms HG 8.63 and 5.48.

Students can print at printers close to HG 5.48 and at the tenth floor. Working locations for notebook use are available in HG 5.48, and also in the lounge at the eighth floor for quick notebook use. The OGO-rooms at the tenth floor can be used for notebooks in case they are not scheduled for teaching. Details on the regulations on the use of the computer facilities can be accessed at www.win.tue.nl/masterprogramguide/regulations

For problems with student e-mail accounts, please contact the ICT Information and Service Desk at LG 1.94, telephone number (040)(247) 4649. The Notebooks Help Desk is located at HG 8.86, telephone number (040)(247) 2979.
Further, the department has the policy that printing for students is free of charge, but copying is not facilitated.

Outside the department the student scan do both print and copy with a PAS account.
This PAS account can be loaded by payment at BCF (HG 8.73).
At the department there are 4 student printers. One on floor 5, the others on floor 10.
To prevent the misuse of free printing, students who print more than 500 pages per year shall be brought to the computer service office's attention, and be warned that their account can be blocked, if their printing behavior does not change.
The account can be re-opened after a payment of 20 Euro.

For the notification of malpractices about space-, computer-, and network use, disturbances and questions about hard- and software, people can contact the Bureau Computer Facilities (HG 8.73), tel. (040)(247) 2802, e-mail wshelp@win.tue.nl.

6.3 Study association GEWIS

The study association GEWIS (union of math- and computer-science students) was founded over 25 years ago. GEWIS champions student rights, promotes student interests and offers students extracurricular activities. It organizes excursions to national companies and tries to organize an international study trip on a regular basis. It organizes the freshmen introduction week and the weekly drink on Thursdays from 16:30 until 19:00 in HG 10.52.
GEWIS publishes a magazine "Supremum", a yearbook, and organizes sporting events, (sailing-) weekends, parties and numerous other activities. On request, it is possible to organize an informal gathering at GEWIS. On Mondays, Wednesdays and Fridays from 12:30 to 13:30, GEWIS provides a book sale in HG 10.52, offering study books at reduced prices. In addition, the GEWIS-website offers old exams.
The education commissary of GEWIS plays an important role as representative of students in the education processes.
GEWIS can be reached at: HG 10.52, telephone number (040)(247) 2815, e-mail: bestuur@gewis.nl and www.gewis.nl.

6.4 Information resources

Current information on program regulations, program changes, changes in the course schedules, practical courses, exams and other important matters is available as listed below.

Leading information on the program:

- The master program guide is available in print at the desk at the Student Administration office and digitally on the website http://w3.win.tue.nl/nl/opleidingen/masteropleidingen/studenten_informatica/cse/
- The Education and Examination Regulations and Examination Rules and Procedures may be found on website www.win.tue.nl/masterprogramguide/regulations

Personal contact at the department:

- The master study advisor: dr. J.P. Veltkamp in room HG 6.38, consulting-hours at Monday, Tuesday and Thursday from 17:00 to 18:00 or e-mail j.p.veltkamp@tue.nl.

Study advisor dr. J.P. Veltkamp

- Student Administration in room HG 6.45 (inquiries desk) or at telephone number (040)(247) 2379, for general information and inquiries about study arrangements, regulations, schedules and calendars and study results. The opening times of the inquiries desk are for students from 11:00 to 12:00, and from 13:00 to 15:00.
- International students coordinator: E. van den Hurk in room HG 6.46, telephone number (040)(247) 2752 or e-mail international.office.win@tue.nl
- The Study Association GEWIS is in room HG 10.52 or at telephone number (040)(247) 2815.

Personal contact at the university:

- The Education and Student Service Center is in room HG 0.72 or at telephone number (040)(247) 8015 for general information and inquiries about financial aid, student assistantships, admissions, university passes, exam regulations etc.
- International student affairs: International Office in room HG 0.72, telephone number (040)(247) 8015 or e-mail io@tue.nl.

Several internet sources of information are available:

- The website at w3.tue.nl provides general TU/e information.
- Information about the department, academic counseling, social events and activities, etc. can be found at w3.win.tue.nl.
- The electronic course catalog can be accessed at owinfo.tue.nl and contains current course information. Also examinations and course schedules are available at this webpage.
- Information about education in computer science is available at www.win.tue.nl/masterprogramguide/regulations
- Video recordings of lectures: http://Videocollege.tue.nl

At the start of each semester kick-off meetings are organized to inform CSE-students on relevant issues.

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