

**Faculty of Science**

# **Prospectus 2010 - 2011**

**Information Science**  
**Master**

**Radboud University Nijmegen**

# Preface

This is the prospectus for the 2010 master programme of Information Science of the Radboud University, Nijmegen. This prospectus contains information about the contents of the programme and courses. Furthermore a lot of practical information is given.

This prospectus has been made with care. Nevertheless, it is possible that it contains some inaccuracies and the authors cannot be held responsible for those. No rights can be derived from the information in this prospectus. Any comments can be sent to Vera Kamphuis,  
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July 2010

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# 1 Introduction

## 1.1 Welcome

Welcome to the Institute for Computing and Information Sciences. The institute is part of the Faculty of Science of the Radboud University Nijmegen, and is responsible for the academic programmes in Computing and Information Sciences. At our institute you can follow a Bachelor programme (3 years) and/or a Master programme (1 year for Information Science; 2 years for Computing Science). The Radboud University Nijmegen is a general university, offering almost all possible academic programmes, ranging from Arts and Law, to Medicine and Science. The Master programmes allow a substantial choice of topics from different areas, thereby offering the possibility of combinations of different studies.

The one-year Master of Science programme in Information Science constitutes the follow-up to the Bachelor programme of Information Science, and focuses in more detail on Business Intelligence and Digital Security.

### Credit point system

The Radboud University uses the European Credit Transfer System (ec) employed by all universities in the European Union. One year is 60 ec, therefore the Master programme of Information Science comprises 60 ec.

### Admission

The master programme of Information Science requires a Bachelors degree in Information Science from the Radboud University, or an equivalent degree. Also students with an post Polytechnic-degree (Dutch: HBO-diploma) can be qualified, although they are always obliged to do an extra, individual transition programme ("schakelprogramma") of at least 30 ec before entering the master programme as a master student. These students start as bachelor students until they finish their transition programme. A special intake procedure has been set up for this group of students. Since the transition programme consists of courses from the Bachelor programma, it is usually taught in Dutch. See chapter 2 for more details on the special programme for post-Polytechnic bachelor students.

### Enrollment

The Central Student Administration takes care of all student enrollments at Radboud University Nijmegen. If you are already a student at the Radboud University, re-enrollment is done via Internet. In the months prior to re-enrollment, you will receive further information on this. In order to obtain your student and registration cards on time, you are requested to arrange your re-enrollment immediately after 1 June. You will receive your student card and registration card on average six weeks after your enrollment has been processed. Further information on enrollment can be found in the Student Statute and on the site <http://www.ru.nl/studenteren> (English version <http://www.ru.nl/students/general/>). If you are graduating, you arrange your de-registration with the University Certification Bureau. For any questions about enrollment, please go to the Central Student Desk.

In the remainder of this chapter you will find some practical information and an overview of important dates, names and addresses. More information can be found on the website of the institute, <http://www.ru.nl/iii/>.

## 1.2 Organisation and practical matters

### Education Office

All practical matters regarding the planning of courses and exams as well as various administrative matters regarding students are taken care of by the Education Office. The staff members of the education office are listed further on in this chapter (see "Important names and addresses"). The coordinator of studies for Information Sciences is Vera Kamphuis, [V.Kamphuis@cs.ru.nl](mailto:V.Kamphuis@cs.ru.nl) and the coordinator of studies for Computing Science is Yella Kleijnen, [Y.Kleijnen@cs.ru.nl](mailto:Y.Kleijnen@cs.ru.nl).

The secretary's office of the Education Office can be found in the Huygens building, room HG02.540. General phone number is 024-365 20 84. In the course of the academic year 2010-2011 the education office will move to the ground floor, wing 5. This will probably happen somewhere in January 2011. Further information will be provided.

### Course programmes and courses

See chapters 2 and 3 for further information about programmes and courses. Information on the programmes is also available on the website. The main link for this is <http://www.ru.nl/iii/> where subpages with practical information can be found.

### Timetable and course information

When and where a course or an examination is planned can be found through the time table viewer on [www.ru.nl/rooster](http://www.ru.nl/rooster) (Dutch and English). With this timetable viewer you are able to compose your personal weekly timetable for your individual combination of courses.

### Communication

A lot of communication in our institute is done electronically. Lecturers use Blackboard, e-mail or wiki in their courses. Also, the Education Office uses Blackboard and e-mail for important announcements regarding timetables or exams. When you enroll as a student in one of our programmes, you will be added to the Blackboard community for students of our institute (*NIII-onderwijs*). For this, we will use your official RU-e-mail address. *It is your responsibility to make sure that this address always remains intact!*

**Please note:** if you're not enrolled as a student before 15 September, it is possible that your name is not on the list of so called "active" students. We are not able to enroll "not

active"students, and therefore you have to enroll yourself for the Blackboard community *NIII-onderwijs*.

### **Important names and addresses**

Important names and addresses of various people and committees in our institute can be found in the appendix (chapter 4). Also, you will find there the contact details of the **master advisor**, Dr. Theo Schouten (T.Schouten@cs.ru.nl), the advisor for HBO-students, Dr. T.Schouten (t.schouten@cs.ru.nl ) and the **master thesis coordinator**, Dr. Patrick van Bommel (pvb@cs.ru.nl).

## **1.3 New in 2010**

### **Fall Break**

Within the institute for Computing and Information Sciences, there will be **no** Fall break in October 2010.

A few years ago the RU did away with the Fall Break, but it is still possible that a Faculty indicates a week in October during which a Fall break may be planned. Institutes decide for themselves if they schedule the indicated week as a holiday.

In 2010 the indicated week is the week before the official quartal break (period of two weeks during which no classes are scheduled, but possibly examinations). Having a Fall break before that would therefore create a course-free period of three weeks. The Education Board of the institute has decided that this is undesirable, and has therefore skipped the Fall break for this year.

#### **Important note:**

**This applies to all Computing Science and Information Science courses** (recognizable by a code starting with IMC..., IMK... or I00...).

**If you attend courses from another faculty, please check the planning schedule for that particular course to see whether a Fall break is scheduled or not .**

### **Student Portal**

#### **Introduction of the student portal**

Students who enroll the Radboud University for the first time will receive an account for the new Student Portal. This portal provides so-called "single sign-in" access to several concerns systems used in our university. The big advantage is that you don't have to log in into these systems separately, but you just login to the portal in order to reach all the applications you

need to use.

During the summer holiday, all new students will receive more information by mail.

The portal provides you with recent information on:

- the 5 latest unread emails
- the 5 latest marks on examinations
- the 5 latest announcements in Blackboard
- Radboud University news
- the latest news from news feeds selected by the student himself
- news on time tables
- etc.

Development of the student portal is an ongoing project and hasn't finished yet. At a late stage it will for instance also be possible to enroll for special activities in the University Sport Centre.

### **For whom?**

First every new student will receive an account: first year bachelor students, first year master students who finished their bachelor elsewhere, poly-technic bachelor students (HBO-doorstroomers). These new students will have access to the portal as of the beginning of the new academic year; students who are already enrolled at Radboud University will receive an account further on in the first semester.

Unfortunately the language used within the student portal is Dutch. Because of this foreign students will receive their account a few weeks later. Until then they will receive instructions for use of the systems that are already available, such as KISS/TIS and Blackboard. Information on these systems is provided later on in this prospectus.

A demonstration movie is available at: [student.ru.nl](http://student.ru.nl)

### **Questions and/or problems**

With questions or problems visit the "Studentenbalie", Comeniuslaan 4,  
<mailto:Studentenportal@ru.nl>

## **1.4 Administrative details: exams**

### **Registration for courses and course exams**

If you want to take part in a course or an exam, you must register yourself by means of the student internet service system KISS/TIS. More information on this can be found below.

*For courses provided by the institute of Computing and Information Sciences (starting with the course code I), a registration for the course is automatically also transferred to a registration for the first course exam. Nevertheless you should **always check** in time whether you have been registered for the exam. If you have not been registered, your grade cannot be administered and you will have to take part in the next examination opportunity. For the next opportunity you have to register yourself via KISS/TIS.*

## The Master examination

When you have completed all courses of the programme, you qualify for the Master Examination. You have to apply for this examination at the Student Administration / Examination Office of the Faculty (FSA). To register for this examination, you must submit the following documents:

- valid student card (two cards: registration card **plus** student card. The one is not valid without the other)
- only for students who obtained their bachelor certificate elsewhere: bachelor certificate (or kandidaats certificate)
- only for students who obtained their bachelor certificate elsewhere: an extract from the population register or register of persons, or a copy of the birth certificate
- Only for students who were registered as external students during part of their study: a confirmation of external student status. This is a statement from the institute confirming that the student in question did not receive any education during the period that he/she was registered as an external student.

The Student Administration/Examination Office will only register students for the Master's examination if *all the results* of the interim examinations are in the possession of and have been processed by the Student Administration/Examination Office. **Important note:** *For students who have enrolled the master programme as of August 2009, unsatisfactory marks (i.e. < 6.0) are not allowed on your grade list, so you only qualify when all your results are higher than or equal to 6.0.* Make sure that all your grades have been processed. You **must check this yourself**. If you register for your examination and not all the results have been processed, you will fail your examination and have to re-apply.

The regulations governing the examinations in August are somewhat different. For these, students can register up to May 31, 2011 and may do so even if several marks have not yet been obtained. These marks have to be delivered before August 31, 2011.

There are 11 examinations dates scheduled each year (usually the last Friday of the month, provided this is not an official holiday; in July there is no examination date at all). Please check the planning schedule on the notice boards at the FSA. Students should register for the examinations no later than the closing date. The diplomas are presented once every three months. If students need proof of graduation before the date of presentation (e.g. when applying for a job), they can obtain written proof of graduation from the Examination Board.

Registration for the master exam is only possible for those students who have obtained their bachelor certificate and who are registered as a master student. It is not possible to register for

both your bachelor exam and your master exam at the same time. In fact, you are not allowed to start the master's project before having completed the bachelor's degree (for regular bachelor students) or additional "schakelcursussen"(for post-polytechnic bachelor students).

### **Rules on Teaching and Examination of the Master programme**

The examination regulations have been laid down in two documents. The Education and Examination Regulations (OER) govern the general organization and scope of education and examinations. More specific regulations can be found in the Rules and Guidelines of the Examination Committee.

The full text of the OER can be found on the Internet

<http://www.ru.nl/iii/organisatie/examencommissie/>. The official document is in Dutch, but for the convenience of foreign students a translation is provided (same site).

### **Examination Board and Examination Appeals Board**

With regard to examination-related matters, students may first contact the Examination board of the Institute for Computing and Information Sciences ([examencommissie@cs.ru.nl](mailto:examencommissie@cs.ru.nl)). In the case of conflict, students can appeal to the Examination Appeals Board of the Radboud University Nijmegen. The procedure to be followed is described in the "Studentenstatuut" on [www.ru.nl/studenten/](http://www.ru.nl/studenten/) (see onder regelingen, conflicten en klachten (only Dutch)).

The examination board looks into matters only if you provide them with the following information:

- name of the student
- student number
- study programme (i.e. Computing Science or Information Science)
- which curriculum (i.e. year in which you started)
- if it concerns a specific course
  - name of the course
  - exam code
  - name of the lecturer
  - Spring or Fall semester
- details on the request

The Examination Board will answer as soon as possible.

## **1.5 Internet services**

### **KISS**

The Radboud University Nijmegen offers all students free access to the Internet and free web mail. Through KISS, students can enroll for courses, sign up for exams, and check their exam results by computer. Every student receives up to 100 MB of free disk space for his or her own website. These 'KISS Services' will remain available for at least 6 months after the student has left the Radboud University Nijmegen.

Please note that the KISS password does not give you access to the computers available on campus. For this, the faculty will supply you with a separate password.

*Opening hours KISS helpdesk*

Mondays-Fridays: 10 A.M.-5 P.M.

(closed on the first Friday afternoon of each month)

## **Blackboard**

The KISS password you receive will also give you access to the Radboud University digital learning environment system *Blackboard*. Lecturers use Blackboard to supply information about their course, send announcements etc. Blackboard is also used by the Education office of the Institute for Computing and Information Sciences to communicate important information (on matters regarding education) to students. Upon registering as a student, you will be enrolled in our community of ICIS-students (*NIII-Onderwijs*) with your official RU-e-mail address. *Please make sure that this remains intact always.*

## **New: Student Portal**

Students who enroll the Radboud University for the first time will receive an account for the new Student Portal. This portal provides so-called "single sign-in" access to several concerns systems used in our university. **For further information, see the description of the Student Portal in the section New in 2010.**

## **1.6 The Statutes for Students at the Radboud University**

The student statutes consist of a description of the rights and responsibilities of all students registered at the Radboud Universiteit, based on statutory and university regulations.

The student statutes and its appendices can be found on: <http://www.ru.nl/studenten/> (see under "Regelingen").

## **1.7 Finding a job**

### **BBB**

Job prospects for students of Computing or Information Science are excellent; many students already find a job before they graduate. Companies are keen to employ students with an academic career in IT-related disciplines. Every year the 'BBB' ("Bèta Bedrijven Beurs")

organizes a job-market where companies present themselves to students. This annual career-event helps undergraduate and graduate students scout the job-market.

The BBB-event takes place in Spring semester at the Science Faculty (for the next event and more information see <http://www.bbb.science.ru.nl/>). A great number of companies, organizations as well as follow-up degree programmes present themselves. Companies are present with a display and give lectures. You can gather information and talk with recruiters. Senior and PhD students can apply on-line around the time of the exhibition and stand a chance to be invited by one or more of the companies for an interview. These interviews are organized by BBB a few weeks after the exhibition. The chances to be invited at that moment are much higher than when you send an open application to a company.

The exhibition is renowned for its casual atmosphere and for its service to visitors. Admission is free, no registering is needed and everybody receives the BBB-career guide.

Prior to the exhibition, BBB organizes workshops on a variety of topics that are relevant for job-seekers and career-starters, such as: interview training, case studies, but also more light-hearted topics.

Contact address: Heyendaalseweg 135, HG00.154, 024-3652388,  
<http://www.bbb.science.ru.nl/>, e-mail: [bbb@science.ru.nl](mailto:bbb@science.ru.nl)

To provide additional assistance in applying for jobs, the central Students Affairs Office at Comeniuslaan 4-6 also offers courses in presentation and has various facilities for job-orientation. More information can be found at their website,  
[http://www.ru.nl/studenten/na\\_je\\_studie/informatiecentrum/](http://www.ru.nl/studenten/na_je_studie/informatiecentrum/) (website in Dutch).

# 2 Master programme Information Sciences

## 2.1 The master programme: introduction

All of the faculties of the Radboud University have implemented the bachelor-master structure. As the same structure has been implemented in most European countries, it is much easier to compare the university training programmes and it is easier to switch between universities. The academic programmes are made up of two components:

- Bachelor programme
- Master programme

The bachelor takes 3 years, the first of which (*propedeuse*) concerns foundation courses. The courses of the bachelor programme are generally taught in Dutch. The programme is broadly based and it prepares you for the master programme. After completing this programme you will receive the bachelor's degree, at which time you may call yourself *Bachelor of Science (BSc)*.

The master programme of Information Science comprises one year (60 ec), and focuses on Business Engineering, Information architecture and Digital Security. The courses are taught in English. Upon completing your studies, you will receive your master's degree and you may call yourself *Master of Science (MSc)*.

The master programme of Information Science 2010 contains several components.

- a compulsory part (24 ec),
- room for specialisation and free choice (12 ec),
- and of course the master's thesis (24 ec).

Within the *specialisation*, 6 ec should be chosen from a given selection of courses that provide further deepening of your information science background. The remaining 6 ec is so-called "vrije ruimte" (free choice). The only condition that should be fulfilled here is that there is no overlap between the course(s) of your choice and the other courses of your programme. The courses of your specialisation and free choice must be approved by the Examination board.

In your *master's thesis*, you will show that you are able to analyse a problem in information science at master level and design a solution for this problem using scientific methods and techniques. It is possible to combine research for the master's project with an internship in a suitable company.

An more detailed description of the content of the master programme as well as the overview of courses and their placement in the year is presented in the next paragraphs.

### **IMPORTANT NOTE:**

The master programme of Information Science is only one year. If you have already taken some master courses last year but you only officially register as a master student this year

because you have only recently completed your bachelor degree, you may find that some courses are no longer part of the current curriculum; in other words, you may find yourself "in between curricula". Please refer to the overview of courses in the next section to see how this affects your programme.

## 2.2 Background and end terms of the master programme

Large and ambitious construction projects require experts with a background at an academic level in the following topics:

- 1. Problem analysis in a realistic context.
- 2. Design of constructions that contribute to the solution of that problem.
- 3. Quality control during construction.
- 4. Support of its implementation in practice.
- 5. Making adaptations related to a changing environment and evolving requirements.

In the world of physical buildings (concrete, steel, glass) the people doing this are called architects. Architects are trained to use their expertise to mediate between conflicting interests of commissioners, contractors, users, and the environment. This requires the architect on the one hand to be able to (learn to) understand the language and concerns of the commissioners, generally through support of domain experts, and on the other hand to be skillful on the level of the materials being used by contractors. As a consequence the educational programme comprises the following topics:

- 1. materials Science & Engineering
- 2. theory
- 3. development
- 4. modeling
- 5. communication
- 6. the human measure (ergonomics etc.)
- 7. ethics

There are special sorts of architects for special types of constructions: low-rise building, high-rise building, interior, urban, landscape, etc. These types are supported by different branches of related material science and theory.

For digital buildings we use an analogous point of view. We use the term i-architect in this case.

The master programme of Information Science offers a solid and comprehensive package of courses that prepares students to be i-architects trained to work in an international setting to combine the technology and human factors in a secure way in an organizational environment.

### End terms of the master programme

The Information Science graduate has an academic working level based on the following competences:

1. The graduate has broad knowledge, skills and insight in the field of Information Science in general and digital architecture in particular, and can independently keep up by disclosing sources of knowledge and experience.
  2. The graduate can describe various aspects of Information Science areas for Information Science related problems and can recognize contributions from (concepts of) these and related areas.
3. The graduate has a professional working attitude to:
- formulate global Information Science Architecture questions, explain their relevance and reduce these questions to innovating solvable subproblems;
  - adapt existing methods to a new situation or develop new problem solving methods;
  - find for small scale solvable problems defendable criteria for its solution (product), its execution (process) and also a specification for the result and a plan for its execution;
  - realize the solution according to this plan, individually or in a small team, where the realization uses abstraction (translating into fundamental concepts); be able to do organizational tasks especially for task distribution and planning;
  - communicate effectively and to justify the activities, both orally and verbally;
  - imbed learning skills to explore mainly autonomously new areas.

### 2.3 Overview of courses

The courses of the master programme are grouped in the following lines:

1. *Rule-based business execution*: the modeling of business application. (Information Systems, Business Rules Specification and Application, Reasoning with Computer Support).
2. *Communication Systems*: supporting the communication in enterprises. (Information Retrieval).
3. *Organisational embedding*: Business & IT alignment (Architecture and new Challenges, Business Process Architecture in Practice, System Development Management).
4. *Security*: allow the system to be operating in an open environment such as the internet (Security in Organizations).
5. *Globalization*: learning how to work in an international context (ICT and Society 2, ICT in a Different Culture).

Special courses provide the essential background in the pillars of information system, information retrieval and security.

In your master's thesis, you will show that you are able to analyse a problem in information science at master level and design a solution for this problem using scientific methods and

techniques. It is possible to combine research for the master's project with an internship in a suitable company.

### Course overview

	<b>Fall semester</b>			<b>Spring semester</b>		
<i>Course code</i>	<i>Course name</i>	<i>ec</i>	<i>quarter</i>	<i>Course code</i>	<i>Course name</i>	<i>ec</i>
I00152	Research Methods (mastercourse)	3	1,2	I00037	ICT and Society 2	3
I00153	Security in Organizations	6	1,2			3,4
IMK003	Business Rules Specification and Application	3	2		<b>Specialisation: one of the following courses</b>	
IMK004	Reasoning with Computer Support	3	2	I00041	Information Retrieval	6
IMK005	Architecture and New Challenges	3	1,2	I00035	Foundations of Information Systems	6
IMK006	Business Process Architecture in Practice <i>Room for 6 specialisation or free choice*</i>	3	1,2	IMC021	System Development Management	6
	<i>Master Thesis (start)</i>	3			<i>Master Thesis (cont.)</i>	21
	<b>Total number of ec</b>	<b>30</b>			<b>Total number of ec</b>	<b>30</b>

*\*Courses can be chosen from the course catalogue of the Radboud University. Suggested courses in the field of Computing and Information Science include:*

*I00054 Cognition and Representation*

*IMI001 ICT in a different culture*

*IMC012 Bayesian and Decision models in AI*

The time table of the courses can be generated via the university time table generator on:  
<http://www.ru.nl/rooster/>.

### **Transition rules**

*N.B.* Students who have already take some master courses in previous years but who only enroll officially in the master programme in 2010 may find themselves "in between curricula". For these students, the following transition rules apply:

(1) Students who have completed the course Capita Selecta information Science (IMK002) will fall under curriculum 2008-2009.

(2) Students who have not completed the course Capita Selecta Information Science (IMK002) will fall under curriculum 2010.

(3) In addition to this, the following courses are equivalent:

- IMK003 Business Rules Specification and Application (3 ec) and IMK004 Reasoning with Computer Support (3 ec) *together* are equivalent with IMK001 Business Rules (6 ec)
  - IMK005 Architecture and New Challenges (3 ec) and IMK006 Business Process Architecture in Practice (3 ec) *together* are equivalent with I00157 R&D System Development Management 1 or I00158 R&D System Development Management 2
- For more information, see the schematic overview of the old and new curriculum.

*If you have any further questions about the master programme, please consult the master advisor, Dr. Theo Schouten (T.Schouten@cs.ru.nl).*

## **2.4 Transition programme for post-Polytechnic bachelors ("HBO-doorstromers")**

Students who enroll in the master's programme of information science following a Polytechnic bachelor training ("HBO-doorstromers") are required to complete a transition programme ("schakelprogramma") consisting of a number of bachelor courses to make up for deficiencies in their prior training. These so-called "schakelcursussen" focus on academic competences relating to the field of information science and preparing for the more advanced level of the master courses. Topics include formal methods and logic, requirements

engineering, information architecture and security. Being part of the bachelor programme, "schakelcursussen" are generally taught in Dutch.

The bachelor courses that HBO-doorstromers should complete depend on their prior education. The standard transition programme defining the minimum level of requirements is listed below. However, the exact programme for each student will be determined during an intake procedure during which the individual background of the student is taken into account.

### Transition programme

	<b>Fall semester</b>			<b>Spring semester</b>			
<i>course code</i>	<i>course name</i>	<i>ec</i>	<i>quarter</i>	<i>course code</i>	<i>course name</i>	<i>ec</i>	<i>quarter</i>
IPK001	Formeel Denken	6	1,2*	IPI004	Beweren en Bewijzen	6	3,4
IBI002	Security	6	1,2	IPI007	Wiskunde 1	3	
IBI003	Informatiesystemen	6	1,2	BKI104	Wiskunde 1A	3	4
IBI007	Onderzoeksmethoden 1	3	1,2	IPK007	Modelleren van Bedrijfsprocessen	3	4
IBK007	Statistiek voor Informatiekunde	3	1,2	IPK008	Fysieke en Digitale Architectuur	3	3,4
IBK008	Architectuur in de digitale wereld	3	2	IPK009	Requirements Engineering	6	3,4
				IPK004	Onderhandelen en Veranderen	3	3,4
	<b>Total amount of ec</b>	<b>27</b>			<b>Total amount of ec</b>	<b>27</b>	

Course descriptions of "schakelcursussen" (mostly in Dutch) can be found in chapter 3.

### Enrollment in February

It is also possible for post-Polytechnic bachelor students to enroll and start their transition programme in February. For these students the same basic programme holds, but they take

the course Beweren and Bewijzen in their second spring semester after enrollment, not in the first. The reason for this is that this course builds on prior knowledge that is taught in the course Formeel Denken, which is taught in the fall semester.

Students who choose to enroll in February should be aware of the fact that they will have a less filled programme in the second spring semester, as there are only few planned master courses for that semester and they cannot yet start their master thesis project (this is because their programme in the preceding first fall semester only contains transition courses, so they have not yet taken any master courses up to that point).

More information for about the planning of the master programme in combination with the transition programme can be found on the website of the institute:  
<http://www.ru.nl/iii/onderwijs/informatiekunde/hbo-doorstroom/>.

### **"Schakelverklaring"**

As indicated above, post-Polytechnic bachelor students who want to take the master programme at our institute will only be enrolled as master students once they have completed the transition programme. Before that time, they are registered as bachelor students. In order to change the registration, students should hand over a so-called "schakelverklaring" at the bureau of registration, showing that they have completed the course of the transition programme. This "schakelverklaring" can be obtained from the Education bureau. The procedure for doing so is listed in the appendix.

In exceptional cases (e.g. in the case of not having completed all transition courses in the first year) post-polytechnic students are informally allowed to take master courses even though they are not yet registered as master students. However, **you are not allowed to start your master's thesis project unless you have completed the transition programme and are officially registered as master student.**

If you are a "HBO-doorstromer" and have any questions about your transition programme or anything else related to your studying in our institute, please contact the advisor for HBO-students, Dr. Theo Schouten, T.Schouten@cs.ru.nl.

## **2.5 Extra-curricular possibilities**

### **Studying abroad**

In the past years, more and more students decided to visit a foreign university for some time during their study. This may include taking courses, working on a project, or attending a summerschool. There are various possibilities for getting a scholarship, e.g. via the Erasmus program (Europe) and the ISEP program (USA). Within the Erasmus program, our institute has relations with universities in different countries such as Sweden, Denmark, Spain, Portugal and Hungary, but a scholarship in other countries is possible as well.

Via a scholarship you may study abroad for a period of 3 to 12 months. Credits (ECs) obtained abroad can usually be acknowledged by the sending university in the Netherlands. In this matter the Examination board can help you select courses that also satisfy the conditions

set by our university. You may also consult the coordinator of external relations at ICIS, Prof.Th. van der Weide (Th.P.vanderweide@cs.ru.nl ), who can help you set up communication with another university. For matters concerning an application for a scholarship, you may contact the International Office of the Radboud University ([www.ru.nl/er/](http://www.ru.nl/er/)).

### **Erasmus Project**

For more information on the Erasmus project you should contact the Erasmus Coordinator dr. Janos Sarbo , or visit the website. If you're interested to know what universities join the project, please visit this site .

### **Study trip: ICT in a different culture**

Our institute takes a special interest in contributing to the development of ICT in other cultures. Our staff members have been involved in lecture programmes in countries like India, Ghana, South-Africa and Uganda, and students have the opportunity to take part in study trips abroad. Countries that have been visited thus far include South Africa, Uganda and India (see <http://studiereis.cs.ru.nl/> and <http://www.ict4kids.nl/> for some reports and additional information in Dutch).

Such extracurricular activities are embedded in courses which are not part of the compulsory programme, but which can be taken as part of the specialisation or free choice in either the Bachelor programme (Community Outreach Project) or the Master programme (ICT in a different culture). A course description is available.

### **Wil Weg Dagen**

Every year the International Office organises the "Wil Weg Dagen" for students who are interested in a stay abroad. For more info on dates and programme visit: [www.ru.nl/wilwegdagen](http://www.ru.nl/wilwegdagen) . Or if you have any questions it is possible to send an email to: [wilweg@io.ru.nl](mailto:wilweg@io.ru.nl).

# **3 Course Descriptions**

## **3.1 Compulsory courses of the master programme**

## Architecture and new Challenges

Course ID: IMK005 3 ec

first semester

prof. dr. M.C.J.D. van

Eekelen

prof. dr. M. van Vliet

### **Introduction**

In this course we prepare students to be i-architects by working on a state-of-the-art architectural challenge. The course brings together the more theoretical courses in a constructive context.

### **Objectives**

Being able to make an innovative architectural design for small practical problems.

### **Subjects**

- Exploring state-of-the-art platforms;
- Special lectures presenting 3 new developments, with a demo and a brainstorm session;
- Examples of innovative applications, their impact and an analysis of their success or failure;
- Practicum: make a simple design for iPhone in SL;
- Map out aspects and requirements; a first step towards a taxonomy.

### **Teaching methods**

Lectures and an extensive architecture practicum as part of GipHouse.

### **Examination**

Presentation and defense of the results of the GipHouse practicum assignments.

### **Prerequisites**

Software Engineering project.

### **Literature**

Roger S. Pressman, Software Engineering, A Practitioner's Approach - International Edition, SEVENTH Edition, McGraw-Hill, ISBN 978-007-126782-3

### **Website**

<http://www.giphouse.science.ru.nl/>

# Business Process Architecture in Practice

Course ID: IMK006 3 ec

first semester

prof. dr. M. van Vliet

## Study investment

- 16 hrs lecture
- 30 hrs laboratory course
- 38 hrs individual study period

## Introduction

This course aims at addressing the main topics which are relevant in the modern process, applications and architecture field. The course has the following four modules

- Software project management
- Enterprise resources planning (ERP) systems
- Business process management and
- Business process architecture.

In project management the different models for project and program management are treated. We also discuss the relation between business strategy and software program management. In enterprise resource planning, ERP systems are explained and different software implementation methodologies which are specific for the implementation of ERP systems are treated. The relation between business processes and application and the different state-of-the-art methodologies for relating processes and applications are discussed in the module business process management. In the final module we discuss business process architecture and introduce current development like Service Oriented Architecture and Cloud Computing.

## Objectives

At the end of the course, students have insight in the developments that the field of business process management and the relation to software applications have undergone and have applied the most recent techniques in order to formulate a state-of-the-art integrated architecture framework.

## Subjects

- Software project management
- Enterprise resources planning (ERP) systems
- Business process management and
- Business process architecture.

## Teaching methods

Alongside the theoretical part of the course, students work in groups in an extensive practicum (GipHouse) on an integral case in which all the above topics are applied in practical work. This practicum is embedded in the course Architecture and New Challenges.

## Examination

The course is examined by means of a written exam (50%) and a mark given for the case (50%).

**Prerequisites**

Software Engineering Project and Business Process Management

# Business Rules Specification and Application

Course ID: IMK003 3 ec

second quarter

dr. S.J.B.A. Hoppenbrouwers

## Introduction

The behaviour of modern day enterprises, as well as society, is largely determined by *rules*.

Examples of such rules are:

1. Taxation laws.
2. Rules governing the application of mortgages.
3. Guidelines guiding doctors in diagnosing patients.

Sometimes these rules reflect *laws* which one would like to enforce strictly. At other times, they represent best-practices that aim to guide people in performing their work. Collectively one may refer to these rules as *business rules*.

Business rules constrain/guide the behaviour of businesses/enterprises, both with regard to operational processes as well as change processes. In addition, business rules are important requirements for the design and implementation of information systems.

In this course we will investigate several aspects of business rules, in particular what they are (and are not), how to formulate them, how they are linked to implementation, and which underlying theoretical issues are at play.

## Objectives

After attending this course, students are able to:

- Position and value BRs as an approach within Information Systems and Enterprise Engineering
- Position and value various basic techniques and standards concerning BRs
- Perform basic specifications in some specific languages related to BPM (RuleSpeak, JBOSS)
- Conceive, develop and refine original and well-founded ideas and argumentations concerning various aspects of BRs and their application in enterprises

## Subjects

- Business Rules
- SBVR
- Rule specification using RuleSpeak
- Formal rule specification
- Rule specification for Rule Engines
- Theoretical backgrounds: logic, natural language, conceptualisation processes

## Teaching methods

- About 6 intensive and interactive lectures, including guest lectures
- A small number of "discussion lectures", for which you have to prepare in advance
- About 9 practical sessions in which you can practice and execute practical specification assignments

## Prerequisites

Some introduction to logic, and a basic knowledge of information systems and IS development.

**Literature**

All provided within the course, digitally

## Informatics and Society 2

Course ID: I00037 3 ec

second semester

dr. L. Consoli

### Study investment

- 32 hrs lecture
- 6 hrs personal study counseling

### Introduction

The course Informatics and Society 2 (Informatica en Samenleving 2) explores cultural and social issues that have been made possible by the development of information technology

Starting from the concepts of privacy and the relationship between informatics and political decision-making processes, we will move on to examine the changes in our way to look at the world caused by the progresses of information technology. We will analyze among others the cultural meaning of hackerism, the role different ethical frameworks play in discussing technological advances, and the social/ethical/cultural implications of artificial intelligence (AI).

### Objectives

The student will:

- be acquainted with a number of philosophical and ethical theories, both in general and applied to his/her object of study;
- be able to recognize the implicit presuppositions in a number of scientific advances of his/her object of study;
- be able to reflect on the normativity of his/her object of study;
- be able to articulate his/her reflection in a number of short papers and a research paper.

### Subjects

- ICT & the human nature
- Ethical theories
- Ethics of ICT (hackerism as case study)
- The mind-body problem
- Philosophical foundations of Artificial Intelligence

### Examination

Students will have to write 4 short essays and a final term paper. There is no final examination planned.

### Literature

Literature references and reading material will be made available through Blackboard.

### Website

<https://blackboard.ru.nl>

## Research methods (master course)

Course ID: **I00152 3 ec**

H.N.B. This course starts two weeks later in the semester!

dr. S.J.B.A. Hoppenbrouwers

### **Study investment**

- 6 hrs groepsgewijs college
- 10 hrs lecture
- 1 hrs personal study counseling
- 24 hrs student project
- 43 hrs individual study period

### **Introduction**

How do you get reliable findings concerning subjects that cannot be captured in a mathematical formula, a test tube, or a computer memory? For example, concerning people and organisations: their opinions, attitudes, behaviour, interaction, language, communication? A researcher in the field of information science creates bridges between typical gamma issues (organisational context, documentation) and bêta-issues (exact science, engineering, technology).

In this course we look at and practice a number of research methods and techniques relevant for information science. It is a "hands on" course: you gain practical experience in (applying) a method of choice and share your experiences with your fellow students (also concerning other methods). The methods/techniques concerned are interviews, workshops, text analysis, and think-aloud protocols.

### **Objectives**

After completion of the course the students can:

- Describe the taught methods and techniques, and the relations between them;
- Decide for each of the methods described whether a method is fit for answering a certain research question;
- Independently and skillfully apply at least one of the methods: make an operational research plan, gather data, analyze data, draw conclusions, present results;
- Relate results to model-based analysis, at the hand of a sound conceptual model of the specific research domain

### **Subjects**

Qualitative research

- Interviews
- Workshops
- Text analysis
- Think Aloud protocols
- Interpretation in science

## **Teaching methods**

After a series of introductory lectures, a hands-on project is done (in small groups) in which the students tackle a real bit of research. Emphasis is on actually doing the real, "messy" work involved in doing research, which leaves less time than usual for planning and reporting. The course therefore focuses on giving the student some limited but real research experience rather than on creating a research plan (which is the aim of the earlier, undergraduate Research Methods course). The project is communicated via the digital workplace (Wiki) of the institute. Regular group feedback sessions and best practice discussions are part of the course setup.

## **Examination**

Evaluation of students is based on their research report (and its evolution as observed on the Wiki), the related oral presentation, and the best practice report. In addition, there will be a small written test that will establish the students knowledge of methods not actually applied by him/her in the course.

## **Prerequisites**

To partake in this course successfully, you should have qualified with respect to basic methodology, for example by successfully completing the bachelor's course "Onderzoeksmethoden". In particular, you can:

- Give criteria for the design and execution of scientific research;
- Apply these criteria to concrete cases;
- Formulate and operationalize research questions; wield the terms conceptual model, empirical model, domain, variable, level of measurement, relation;
- Use advanced querying systems to find professional literature.

## **Literature**

Syllabus and other literature will be provided digitally. The obligatory coursebook is the same as for the Onderzoeksmehtoden course (Bachelor):

- "Social Research Methods", by Alan Bryman; Third edition. Oxford University Press, 2008. ISBN 978-0-19-920295-9

## **Website**

BlackBoard

## **Extra information**

This course is the sequel to the basic course "Onderzoeksmehtoden" in the Bachelor. Research questions and methods play a role in numerous other courses, but are particularly relevant to the writing of the Master's Thesis.

## Reasoning with Computer Support

Course ID: IMK004 3 ec

second quarter

prof. dr. H. Zantema  
dr. A.J. Hommersom

### Introduction

Business rules are often informally specified, but to use these rules in a computer, it is needed to formalize these rules and implement them in software.

An approach to deal with this human knowledge is by representing them as so-called production rules, which were introduced in the early 1970s. Production rules usually represent 'rules of thumb', but they have been successfully applied for planning and design as well. In this course, we will look at various notions of such production systems, such as different types of rules and modes of reasoning. Practical assignments will lead to the development of a production system based on a number of business rules.

As a second part of the course we consider the problem of finding a solution to a given set of constraints, as they occur in planning and scheduling. For instance, one can think of making a planning of a project consisting of several tasks, under constraints involving available man power, tasks that should be finished before other tasks can start, and so on. Typically, such problems may be algorithmically very hard. However, by modern tools based on satisfiability, formalizations of this kind of problems are often easily solved.

### Objectives

At the end of this course, students have insight in modelling business rules and constraint problems in a formal language. Furthermore, they are able to exploit these techniques for solving actual problems in organisations. The emphasis is on practical experience.

### Subjects

- Production systems
- Types of rules
- Modes of reasoning
- Constraint problems
- Satisfiability and variants
- Scheduling problems

### Teaching methods

For both parts of the course there are three lectures of two hours each, and a practical assignment.

### Examination

Examination of this course consists of three parts:

- a written examination on the theory, and

- two practical assignments.

For all three parts the grade should be at least 5, then the final grade is the average of the three parts.

**Prerequisites**

- Beweren en Bewijzen
- Business Rules Specification and Application

**Literature**

Syllabus

# Security in organisations

Course ID: I00153 6 ec

first semester

prof. dr. E.R. Verheul  
drs. G.T. de Koning Gans  
dr. ir. E. Poll

## Study investment

- 32 hrs lecture
- 8 hrs personal study counseling
- 32 hrs laboratory course
- 96 hrs individual study period

## Introduction

Information security deals with the preservation of the confidentiality, integrity and availability of information. The leading standard on information security is ISO 27001 that defines the notion of a Information Security Management System (ISMS). This is a means for the management of an organization to be in control of the information security risks.

Fundamental within ISO 27001 is that information security is considered to be a 'process' and not a 'product' one can simply buy. The process allows management to ensure that others within their organization are implementing security controls that are effective.

One of the difficulties of the information security process is its multidisciplinary nature: it needs to grasp security requirements from the organization business processes (where the managers typically are not savvy on information security) and to translate them to security controls. These controls can be of various types, including ICT technical or cryptographic. Moreover, the process needs to check that the operational effectiveness of the chosen controls is satisfactory and to adapt the controls (or the surrounding framework leading to the controls) if required.

Within the course this process is explored both from a theoretical and a practical level never loosing sight of the computer science perspective. To this end the course also has several 'hands-on' exercises including conducting a Windows EDP audit, a network audit and a network penetration. The course provides the basic information on information security required by the security officer of an organization, by IT security auditors and by IT security consultants. As information security is still a rapidly evolving topic (some might argue it is even still in its infancy) the course can also provide inspiration for further scientific research.

## Objectives

- Learn to control information security risks within an organization in an holistic fashion (procedural, organizational and technical).
- Getting familiar with the leading standards in this area, their shortcomings and practical implementation guidelines.
- To learn to map policies to technical countermeasures and vice versa.
- To learn how to write and enforce security policies.
- To learn some basic techniques in security auditing.
- Getting an idea of the practical aspects of information security.
- Getting inspiration for further scientific research.

## **Subjects**

- International standards for information security and risk management
- Implementing information security and risk management
- Risk analysis methods
- Privacy
- Electronic signatures (law, practice, technical)
- EDP auditing
- Secure development and acquisition of software
- Business continuity management
- Network and database security
- Special topics: pseudonymization, physical access control, digital, ideal

## **Teaching methods**

The course consists of 2 hours of lectures per week and there is a lab session of 2 hours per week. Much of the course will be case-study based. Except to be doing a lot of background reading using the reader.

## **Prerequisites**

The bachelor course Security.

## **Literature**

This course has a reader.

## **Website**

<http://www.cs.ru.nl/~petervr/secorg/>

## **Extra information**

Related courses:

- Software security
- Network security
- But also appropriate courses related to computers and law are an option.

## **3.2 Course suggestions for specialisation or free choice**

## Bayesian and decision models in AI

Course ID: IMC012 6 ec

second semester

dr. P.J.F. Lucas  
dr. A.J. Hommersom

### Study investment

- 24 hrs lecture
- 4 hrs personal study counseling
- 6 hrs laboratory course
- 20 hrs student presentation
- 26 hrs student project
- 10 hrs problem session
- 78 hrs individual study period

### Introduction

Handling uncertain knowledge has been one of the central problems of AI research during the past 30 years. In the 1970s and 1980s uncertainty was handled by means of formalisms that were linked to rule-based representation and reasoning methods. Since the 1990s probabilistic graphical models, in particular Bayesian networks, are seen as the primary formalisms to deal with uncertain knowledge. Both early and new methods for representing uncertainty are studied in the course, where in particular various aspects, such as inference and learning, of Bayesian networks are covered.

### Objectives

At the end of this course, the student should be able to:

- know the cognitive aspects of reasoning with uncertainty
- understand the probabilistic principles of reasoning under uncertainty
- explain the differences between various graphical models
- have insight into model-based approaches to uncertainty reasoning, in particular in the use of Bayesian networks
- have insight into the pros and cons of learning models versus using expert knowledge
- have some experience in experimenting with software to solve problems involving uncertainty

### Subjects

- Introduction: uncertainty, early approaches, Bayesian networks
- Cognitive aspects of uncertainty reasoning
- Applications of Bayesian networks
- Review of basic probability theory
- Bayesian networks: principles
- Building Bayesian networks
- Markov independence
- Reasoning with Bayesian networks
- Building Bayesian networks

- Software
- Learning Bayesian networks
- Decision making

### **Teaching methods**

- lectures
- seminar
- tutorials
- practical assignment

### **Examination**

Written exam in addition to seminar presentations and practical work.

### **Prerequisites**

Bachelor course "Knowledge representation and reasoning".

### **Literature**

- P.J.F. Lucas and L.C. van der Gaag, Principles of Expert Systems, Addison-Wesley, Wokingham, 1991, Chapter 5.
- K.B. Korb and A.E. Nicholson, Bayesian Artificial Intelligence, Chapman & Hall, Boca Raton, 2004.
- R.G. Cowell, A.P. Dawid, S.L. Lauritzen and D.J. Spiegelhalter, Probabilistic Networks and Expert Systems, Springer, New York, 1999. (Available as e-book via <http://www.metapress.com/content/978-0-387-98767-5>)
- F.V. Jensen and T. Nielsen, Bayesian Networks and Decision Graphs, Springer, New York, 2007.

### **Website**

<http://www.cs.ru.nl/~peterl/teaching/CI/>

### **Extra information**

This course was previously called "Computational Intelligence". The course is part of the Computing Science theme Artificial Intelligence and also part of the AI master programme.

# Cognition and Representation

Course ID: **I00054** 6 ec

first semester

dr. J.J. Sarbo

## **Study investment**

- 30 hrs groepsgewijs college
- 30 hrs lecture
- 4 hrs personal study counseling
- 104 hrs individual study period

## **Introduction**

The term "representation" usually refers to formalization, including a deductive or inductive use of formalized knowledge. This view, maintained by computer science, is opposed to the interpretation of knowledge by cognitive theory, according to which it is an expression of thoughts by a human observer. In this course we learn how these two conceptions of knowledge, formal and meaningful, can be linked with one another through a cognitively based model of knowledge representation. In addition, we learn how the proposed representation can be used for a uniform modelling of knowledge in different domains.

## **Objectives**

- Making acquaintance with a theory of signs and signification.
- The definition of a model of cognitive activity.
- Introduction of a model for 'naïf' logic, language, reasoning, and mathematics.
- Learning the differences between formal and human interpretation.

## **Subjects**

- Signs and interpretation
- Conceptualization processes
- Processing schema
- Naïve logical interpretation
- Syntactic and semantic language modeling
- Application in reasoning and mathematics
- Application in text summarization

## **Teaching methods**

This course makes use of problem directed education. The students are individually working on weekly exercises. A full solution of the exercises are developed in class.

## **Examination**

A midsemester and a final test, both must be 5.5 or higher. The final grade is defined by the average of the two tests. This test grade can be adjusted by the average grade for the weekly exercises, but only if the latter is above the test grade (otherwise, no correction is applied).

## **Prerequisites**

Basic knowledge in propositional logic, as well as in deductive and inductive reasoning

(including mathematical induction) is required.

**Literature**

The Lecture Notes of the course are distributed via Blackboard.

**Website**

<http://osiris.cs.kun.nl/~janos/CR.html>

**Extra information**

This course makes use of problem directed education.

# Foundations of Information Systems

Course ID: I00035 6 ec

second semester

dr. P. van Bommel

## Study investment

- 32 hrs lecture
- 32 hrs problem session
- 104 hrs individual study period

## Introduction

In this course we study foundations of information systems in detail. These fundamental aspects will be organized around the notion of model transformation, in particular *transformation of information models*. We will specify the *syntax and semantics* of concrete transformations. This will lead us to a framework for *reasoning* about transformations, in which different design strategies can be considered, for example quality-driven design strategies. Our study of foundations has a theoretical nature, but practical cases will also be considered.

## Objectives

You will learn:

1. transformation of information models
2. reasoning about transformations
3. optimization of transformations

## Subjects

- Basic *information language* with a suitable representation mechanism.
- *Complexity* of the representation mechanism.
- *Wellformedness conditions* for representations, with a parameterized generation algorithm.
- *Correctness proof* of generation algorithms.
- Rule-based *population transformation* and operation transformation.
- Distinction between generation operators and *mutation operators*.
- Application of these operators in (*interactive or automated*) *design processes*.
- *Predicting and comparing the behaviour* of different transformation strategies.

Examples of transformations are the following. *Data format* may change when it is transferred between systems, including changes in data structure, data model, data schema, data types. *Interpretation of data* may vary when it is passed on from one person to another. Changes in interpretation belong to data semantics rather than data structure. *Level of detail* may change when exchanging data between departments or organizations, for example going from co-workers to managers or from local authorities to central government. *Systems development phase* of data models may vary, for example when implementation-independent models are mapped to implementation-oriented models.

## Examination

Individual student paper (p) and central written examination (e). Every student must write a paper. This paper will be 20% of the final result. The final result (f) is computed as follows:  
IF  $e < 5$  OR  $p < 5$  THEN  $f = \min(e, p)$  ELSE  $f = 0.2 * p + 0.8 * e$ .

### **Prerequisites**

It would be good if you have some experience with information models, for example the relational model or the entity-relationship model (or a similar model). Furthermore, it would be good if you can handle basic mathematical definitions.

### **Literature**

- The *lecture notes*.
- Instructions for the *student paper*.
- *Handbook of data modelling* (from 1959 until 2008).
- Suggestions for *further reading* (not required).

## **ICT in a different culture**

Course ID: IMI001 6 ec

first semester

prof. dr. ir. T.P. van der Weide

### **Study investment**

- 32 hrs lecture
- 64 hrs student project
- 72 hrs individual study period

### **Introduction**

This course is an international broadening course to explore levels, practice and opportunities and threats for Information and Communication Technology in a non-western context.

Each year, some specific context is chosen, referred to as the country of interest. This context is further refined by specific research projects.

In 2010/2011 we intend to visit China.

### **Objectives**

As a result of active participation in the student study tour and a substantive study of literature, the student will be able for the specific situation in the country of interest:

1. To describe the overall economic situation, and the governmental policy relating to it. Furthermore also the situation on micro economic level; trained and untrained people, employees of small businesses, unemployed and people living in rural and urban areas.
2. To describe the educational level of the schools and universities, and the governmental policy towards it. Also the policy towards people without access or with difficult access to education, and its corresponding educational level.
3. Outline the different levels of demand of the market, and also how these levels compare to the Dutch educational levels.
4. To indicate the opportunities for Computing Science and Information Science research for both universities and industry.
5. To indicate current ICT utilisation in universities, government and industry both in the urban as well as in the rural areas. Hereby focusing on the type of demand, and to what extent the current level of access can answer this demand.
6. To describe the current status of the infrastructure in the country of interest with special emphasis on availability of hardware (distribution and communication channels, supply of parts), opportunities for maintenance and available knowledge and skills (at several levels including the Dutch vocational levels MBO and HBO).
7. To be able to motivate to your own insight which types of development work have the desired effect, and how they correlate with governmental policies.

After successful completion of the course, students are capable to provide a motivated answer on questions regarding the role of ICT in the country of interest, focusing on the one hand on usefulness and sensibility issues and on the other hand on feasibility restrictions and opportunities in the context of

- industry (in what sectors and what problems can be expected?)
- government (idem)
- university (idem)
- society (idem)

This should also include cultural and other societal aspects of relevance.

## **Subjects**

1. Understanding cultural differences
2. International cooperation
3. In-depth study of country to be visited
4. Research methods
5. Competency development
6. ICT in different cultures

## **Teaching methods**

The course is organized around a number of small research projects that preferably are supplied by companies participating in this course. Companies are invited to participate in this course, and to contribute interesting research projects.

The course consists of three phases:

1. Initial phase. The students formulate their research question, and prepare the research to be done during the visit in the country of interest. Also they prepare themselves on the specific cultural background of that (part of the) country. During this phase, the organization of the concluding seminar is set up.
2. The actual research phase: 10 days research in destination country.
3. Evaluation phase. During this phase, the students will finish their research report. Furthermore, they will organize a seminar in which the results are presented. Some extra activities are also organized during this seminar, such as guest speakers and a forum discussion.

The students work in groups on their research projects. At regular moments they provide feedback on the performance of the other members in their group. This feedback will be used during the assignment of an individual mark for each participant. After the initial phase there will be an intermediate mark. A positive intermediate mark is required to participate in phase 2.

The students will also be part of organization tasks such as the organization of the seminar, p.r. activities, creating a professional combined research evaluation report for internal and external distribution.

This contribution will also be part of the mark of each student.

**Examination**

The students write a short paper about their research. Furthermore, the students are marked for their contribution to organizational activities in the context of this course (such as organizing the final seminar).

**Literature**

The students will receive material during the course.

**Website**

<http://studiereis.cs.ru.nl/>

**Extra information**

The course will only be organized when funds have been raised to a sufficient level.

## Information Retrieval

Course ID: **I00041** 6 ec

second semester

prof. dr. ir. T.P. van der

Weide

prof. dr. ir. W. Kraaij

### Study investment

- 30 hrs lecture
- 34 hrs problem session
- 104 hrs individual study period

### Introduction

Finding relevant documents no longer seems to be the major challenge of state-of-the-art search engines. Where recall and precision were major concerns in the early days of their existence, trying to convey information rather than just data seems to be a major concern nowadays. Offering a long list of documents in order of their relevance score is known to be a too simple interface.

In order to improve on this, solid knowledge of the information retrieval problem and its main techniques is imperative. As there are still many questions about the essentials, a strong relation with ongoing research activities is indispensable.

IR (A constructive approach to Information Retrieval) treats the backgrounds of Information Retrieval:

1. How do people search for information, and how can this be formalized?
2. How do people describe what they mean, and how can we formalize meaning?
3. How can these points be combined?

An important application area is the World Wide Web.

### Objectives

The goals of the course IR (A constructive approach to Information Retrieval) is that its participants

1. are familiar with the base models that are used for Information Retrieval.
2. have knowledge of query languages, both syntactically and semantically.
3. are familiar with information extraction from documents, inter-document relations and their appreciation.
4. have insight and proficiency in design and construction of search engines.
5. have insight in interaction techniques to support searchers in their quest for information.
6. have some experience with scientific literature in this field.

### Subjects

The course consists of three main parts:

1. Fundamentals
  1. After a discussion on the problem areas of Information Retrieval,
  2. the evaluation methods for Information Retrieval are discussed.
  3. The Boolean model is discussed, together with techniques related with inverted list document representation.

4. The vector model is the most used model. As a method for knowledge extraction, the singular value decomposition (main component analysis) is discussed.
5. The probabilistic model applies Bayesian learning techniques to Information Retrieval.
2. Knowledge extraction and Information processing
  1. Query languages in relation with cognitive aspects of information searching.
  2. Autonomous query improvement techniques (global context analysis). Guided query improvement techniques (feedback).
  3. Pseudo relevance feedback (local context analysis).
  4. Clustering techniques for knowledge extraction
3. Exploiting link structure and access data on the Web
  1. Web retrieval.
  2. Exploring the reference structure between documents (for example, PageRank).
  3. Exploring document appreciations (collaborative techniques).
  4. Clickdata analysis, learning to rank
  5. Special topics contributed by the participants

During the course, guest speakers are invited to discuss state-of-the-art topics.

### **Teaching methods**

1. The course is divided in parts, each part is concluded with a test.
2. Each week there are 4 contact hours, in which the new material is presented and exercised. Several problems sessions involve exercises with IR software tools.
3. The participants have to make a contribution to the course (see below).

### **Student contribution**

Participants have to choose a topic from the most recent SIGIR conference or TREC conference. These contributions will be centered around special themes in Information Retrieval. The themes will vary from year to year. The actual themes will be announced during the lectures.

The students make an extended summary of the topic chosen, and present this during the lecture. The contributions are peer reviewed by the participants of the course.

### **Examination**

Written exam in addition to presentation and practical work.

### **Prerequisites**

Participant of IR (A constructive approach to Information Retrieval) should have the base qualifications as provided by the bachelor Computing science or Information Science.

### **Literature**

The following book will be used: Introduction to Information Retrieval, C.C. Manning, P. Raghavan, H. Schutze

Editor: Cambridge

(E-book available at <http://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf>)

Recommended: Information Retrieval in practice. W. Bruce Croft, Donald Metzler, Trevor Strohman

Editor: Pearson

Lecture notes will be made available via Blackboard.

**Website**

[http://blackboard.ru.nl/bin/common/course.pl?course\\_id=\\_15923\\_1](http://blackboard.ru.nl/bin/common/course.pl?course_id=_15923_1)

## Law in Cyberspace

Course ID: IMC006 6 ec

first semester

dr. ir. E. Poll

### **Study investment**

- 12 hrs lecture
- 24 hrs problem session
- 132 hrs individual study period

### **Introduction**

Short description:

Can I legally play a dvd bought in the US on a European dvd player? Is downloading music from the internet stealing? Is using an open WiFi access point legally permissible? What about liability when illegal activities are conducted by someone else than the owner of the access points? Do I have a right to be anonymous on the Internet?

These are but some of the legal questions arising in the network society. In this course, provided by researchers of TILT - the Tilburg

Institute of Law, Technology, and Society - an introduction is provided to the role of law with regard to ICT. Focusing on problems arising in everyday life online, the course will provide an overview of these issues from a legal perspective.

### **Subjects**

The course will start with a brief introduction to law, regulation and the defining features of core two legal areas: private law and criminal law. This is followed by lectures on important areas within Cyberlaw:

- privacy, data protection, and identity management
- copyright and 'code' as code
- computer crime I
- computer crime II
- electronic signatures and e-commerce.

### **Examination**

written exam

### **Extra information**

Precise information will be available in September 2010.

# System Development Management 1

Course ID: IMC021 6 ec

second semester

dr. T.E. Schouten

## Study investment

- 16 hrs lecture
- 112 hrs student project
- 40 hrs individual study period

## Introduction

SDM1 resembles the phase in an IT career in which the project leader takes responsibility for the management of a software development project. Within SDM1 we address the project management aspects of the whole life cycle of a system development project, from definition study through system design, system development and system implementation all the way to the maintenance of a system in an operational environment.

The course consists of a theoretical (2EC) and a (4EC) practical component. The practical component is being carried out within "GiP-House", managing students from the "Software Engineering course. GiP-House closely resembles a real-life modern software house in which the students of this course perform roles as: Project manager, Quality manager, Contract Owner, Public Relations Manager, Director. These roles can be adjusted depending on the specific situation of a given semester (e.g. number of students). All students work, within the management structure of GiP-House, under the supervision of the director, with the aim to create an effective and efficient software house management structure. The managers use, if necessary, (internal or external) experts.

## Objectives

SDM1 has the aim that the student, at the end of the course, has all the professional skills of an IT project leader.

## Subjects

For the theoretical topics, see the website:

- project management
- metrics
- scheduling and tracking
- capability maturity model
- component based development
- implementation
- team management, project organization
- requirement analysis

## Teaching methods

There will be about 8 presentations of 2 hour each.

Further working as a manager for about 112 hours as a manager in GiPHouse.

**Examination**

- A written examination
- The quality of your contribution to the management of GiPHouse

**Prerequisites**

Bachelor Computing or Information Science

**Literature**

Software Engineering A practitioners Approach: European Adaptation, seventh edition ,  
Roger S. Pressman  
Sheets of the presentations

**Website**

<http://www.cs.ru.nl/~ths>

**3.3 Courses of the transition programme  
("schakelprogramma")**

## Architectuur in de Digitale Wereld

Vakcode: **IBK008 3 ec**

tweede kwartaal

dr. D.N. Jansen

dr. H. Wupper

### **Inleiding**

Door omstandigheden is over deze cursus nog geen nadere informatie beschikbaar. Mogelijk wordt deze in de loop van het eerste kwartaal aangevuld. Neem voor meer informatie contact op met de docent, David Jansen ([D.Jansen@cs.ru.nl](mailto:D.Jansen@cs.ru.nl)).

## Beweren en Bewijzen

Vakcode: **IPI004** 6 ec

tweede semester

dr. H. Wupper

dr. E.M.G.M. Hubbers

dr. D.N. Jansen

### **Studielastverdeling**

- 40 uur groepsgewijs college
- 40 uur hoorcollege
- 2 uur individuele begeleiding
- 50 uur projectwerk
- 36 uur zelfstudie

### **Inleiding**

Hoe bereikt men helderheid? Wanneer is een bewering waar? Wanneer doet een ICT-systeem wat het moet doen? We beschouwen verschillende toepassingsgebieden van taal, juridische wetten bijvoorbeeld, en contracten. Voor informatici belangrijke speciale gevallen zijn specificaties (als contract) en algoritmen (uitvoeringsvoorschriften, speciale gevallen van een speciaal geval van wetten). We gaan uit van uitspraken in natuurlijke taal. Deze gaan we

- analyseren en beperken tot constructies die we echt begrijpen, en
- formaliseren, d.w.z. in een notatie gieten met een goed gedefinieerde betekenis.

Vervolgens gaan we

- bestuderen, aan welke regels deze formele uitspraken onderhevig zijn en hoe men tot aantoonbaar ware uitspraken kan komen,
- dit toepassen op de ontwikkeling en validatie van systemen die doen wat ze moeten doen,
- dit alles exemplarisch vergelijken met benaderingen, gebaseerd op enige andere formalismen (SQL, state based systems).

### **Leerdoelen**

#### *Algemene bekwaamheden*

- inconsistenties en incorrectheden aanwijzen in niet deugende uitspraken
- heldere, consistente en correcte uitspraken formuleren
- de correctheid van eigen beweringen beredeneren
- oplossingen systematisch kunnen afleiden c.q. een systematische afleiding presenteren
- actief en constructief meewerken aan het verhelderen van onduidelijke uitspraken
- teksten en discussies structureren d.m.v. begripsdefinities
- het onderscheid kunnen aangeven tussen natuurlijke taal en formele talen
- professioneel kunnen omgaan met verschillende notaties voor dezelfde taal

#### *Specifieke bekwaamheden Logica*

##### **a) propositie- en predikatenlogica**

- herkennen welke redeneerproblemen met propositielogica worden aangepakt en welke niet
- beweringen in natuurlijke taal omzetten naar logica
- de betekenis van logische formules helder in natuurlijke taal weergeven

- de betekenis van de regels voor natuurlijke deductie aangeven
- eenvoudige beweringen bewijzen of weerleggen met behulp van natuurlijke deductie
- bewijzen netjes opschrijven

**b) propositiologica**

- voor gegeven beweringen de waarheidstabellen opstellen
- voor gegeven beweringen aangeven of deze tautologisch zijn
- redeneerfouten herkennen en blootleggen
- aangeven welke verzamelingen van voegtekens al dan niet functioneel volledig zijn

**c) informatica**

- relevante eigenschappen van eenvoudige ingebouwde real-time-systemen en hun onderdelen logisch specificeren
- de juistheid van logische specificaties aantonen
- systemen hierarchisch onderverdelen
- op basis van logische specificaties bewijzen dat een uit de juiste onderdelen samengesteld systeem de verlangde eigenschappen heeft
- systeemanalyse, systeemontwerp en correctheidsbewijs helder presenteren
- het verband aangeven tussen logische en enkele andere specificatieformalismen

**Onderwerpen**

Realiteit, abstractie, modellen, contracten, verborgen aannames, natuurlijke en formele talen, syntaxis en semantiek, typering, propositie- en predikatenlogica, waarheidstabellen, semantische tableaus, natuurlijke deductie, specificatie, correctheid van systemen, Chinese dozen (hierarchische decompositie), bewijsassistenten

**Toelichting werkvormen**

In de elektronische werkplaats werken we samen aan grote projecten en wekelijkse opdrachten. We formuleren in natuurlijke taal zo precies mogelijk wat een bepaald ICT-systeem moet doen (bijvoorbeeld botsingen tussen treinen en auto's voorkomen) en zetten deze specificatie vervolgens om in een formele taal: de predikatenlogica. Daarbij komen we vanzelf allerlei ambiguïteiten tegen; de logica dwingt ons, deze op te lossen. We specificeren op dezelfde manier de aannames die we redelijkerwijs kunnen maken over de onderdelen van zo'n systeem (slagbomen, treinen, besturingskastje, wegenwet). Als alles klopt en goed in elkaar zit, moet formeel bewezen kunnen worden dat het systeem inderdaad aan zijn specificatie voldoet. Om de studietaken competent uit te voeren leer je in zelfstudie iedere week nieuwe stof. In responsiecolleges bespreek je je eigen oplossing en die van anderen.

**Toetsvorm**

De cursus bestaat uit een aantal inhoudelijke blokken. Elk blok wordt afgesloten met een schriftelijk deeltentamen. Ook maak je een groot werkstuk. Voor elk schriftelijk tentamen en voor het werkstuk moet je ten minste een 5,5 hebben.

Het werkstuk maakt 50% van het cijfer uit, de gemiddelde resultaten van de schriftelijke tentamens ook 50%.

Herkansingsmogelijkheid voor elk onderdeel een paar weken later.

**Vereiste voorkennis**

Vertrouwd zijn met het verschil tussen een informele en een formele benadering op het

niveau van de cursus Formeel Denken, Discrete Wiskunde of een vergelijkbare cursus. Enige ervaring met modellering. Enige ervaring met een aantal formele programmeer- en modelleringstalen.

### **Literatuur**

Aangeraden: een leerboek over predikaatlogica en natuurlijke deductie, bijvoorbeeld J.F.A.K. van Benthem et al.: Logica voor informatica; Pearson Education Benelux, 2003, ISBN 90-430-0722-6 of een oudere of nieuwere oplage. Het is een boek waar je ook later nog veel aan kunt hebben. In deze cursus gebruiken we er alleen bepaalde onderdelen van. Je mag ook oudere oplagen of een ander boek gebruiken.

### **Website**

[https://lab.cs.ru.nl/algemeen/Beweren\\_en\\_bewijzen](https://lab.cs.ru.nl/algemeen/Beweren_en_bewijzen)

## Formeel Denken

Vakcode: **IPK001 6 ec**

eerste semester (NB: deze cursus  
begint twee weken later)

dr. F. Wiedijk  
dr. E.M.G.M. Hubbers  
ir. C. Tankink

### Studielastverdeling

- 30 uur hoorcollege
- 30 uur werkcollege
- 108 uur zelfstudie

### Inleiding

Dit is een introductiecursus in de mathematische logica en theoretische informatica. Allerlei onderwerpen uit deze vakgebieden worden kort geïntroduceerd. Tijdens de eerste helft van de cursus (propositielogica en predicaatelogica) bouwt dit op, maar daarna bestaat de cursus uit allerlei niet direct gerelateerde onderwerpen. De cursus is een directe voorbereiding op de cursus Beweren & Bewijzen.

### Leerdoelen

Na afloop van de cursus kunnen de studenten:

- omgaan met de cognitieve stijl van de theoretische informatica
- natuurlijke taal vertalen in logische formules en omgekeerd zowel in propositielogica, predicaatelogica en modale logica
- informeel redeneren over geldigheid van formules in modellen in deze drie logica's
- de begrippen alfabet, woord, formele taal, en de basisoperaties op woorden en talen hanteren
- talen in verband brengen met reguliere expressies en contextvrije grammatica's
- talen in verband brengen met eindige automaten
- basisbegrippen uit de grafentheorie weten en toepassen
- binomiaalcoëfficiënten berekenen en toepassen
- functies met recursie definiëren, en eenvoudige stellingen met inductie bewijzen

### Onderwerpen

Het college is verdeeld in vijf blokken:

- propositielogica
- predicaatelogica
- formele talen en eindige automaten
- discrete wiskunde
- modale logica

Alle blokken zijn ongeveer even lang.

**Toelichting werkvormen**

Het college bestaat uit vijf blokken die met de vijf onderwerpen en de vijf hoofdstukken van de syllabus corresponderen.

Iedere bijeenkomst bestaat uit een uur werkcollege gevolgd door een uur hoorcollege, afgezien van de eerste en laatste bijeenkomst van één van de vijf blokken: de eerste bijeenkomst van elk blok is uitsluitend hoorcollege en de laatste bestaat uit een uur responsiecollege gevolgd door een uur deeltoets.

**Toetsvorm**

Er zijn vijf niet verplichte deeltoetsen en er is een eindtentamen. De deeltoetsen tellen alleen mee als het gemiddelde hoger is dan het tentamencijfer. Voor de precieze berekening van het eindcijfer zie de website.

Studenten die Beweren & Bewijzen al hebben gehaald krijgen deels vrijstelling. Zie ook hiervoor de website.

**Vereiste voorkennis**

Middelbare schoolwiskunde.

**Literatuur**

Het college volgt een dictaat dat geschreven is door Herman Gevers e.a. Dit dictaat is in pdf vorm beschikbaar op de website.

**Website**

<http://www.cs.ru.nl/~freek/courses/fd-2009>

**Bijzonderheden**

Deze cursus wordt gevolgd door studenten Informatiekunde, door HBO-doorstromers Informatiekunde en door studenten Kunstmatige Intelligentie.

## Fysieke en Digitale Architectuur

Vakcode: IPK008 3 ec

tweede semester

dr. H. Wupper

### Studielastverdeling

- 16 uur hoorcollege
- 4 uur presentatie door studenten
- 30 uur projectwerk
- 10 uur werkcollege
- 24 uur zelfstudie

### Inleiding

- De fysieke bouwkunde kent het (beschermd) beroep van **Architect**. Een architect begrijpt wat de bouwheer wil en helpt hem, nog beter te zien wat hij wil, draagt ook alternatieven aan, maakt een ontwerp, vaak zo grensverlegend als het de bouwheer zelf niet zou kunnen, vertegenwoordigt de bouwheer tegenover de aannemer, etc. etc.
- Een architect heeft een brede opleiding:
  - Communicatie,
  - Materiaalkunde,
  - Ontwerp,
  - Vormgeving,
  - De menselijke maat
  - Theorie,
  - Architectuurgeschiedenis,
  - Modelleren.
- De opleiding informatiekunde is de "digitale" tegenhanger van de opleiding tot architect. Een academisch informatiekundige zou best "architect in de digitale wereld" genoemd kunnen worden.
- Dat betekent dat informatiekundestudenten veel kunnen afkijken van de fysieke architectuur
  - zowel van gebouwen (hier kan men veel ook voor informatiekunde relevante dingen gewoon samen *bekijken* en voelen)
  - als van het vak van de architect.

### Leerdoelen

- Uitleggen wat een "digitaal architect" doet aan de hand van analogieën met de fysieke architectuur
- Integraal kijken

- Rekening houden met de menselijke maat bij IT-ontwerpen
- Ervaringen uit de fysieke architectuur toepassen in de IT-wereld

### Onderwerpen

- Ontwerp vanuit verschillende gezichtspunten
- Vormgeving
- De menselijke maat
- Architectuurgeschiedenis
- Modelleren

### Toelichting werkvormen

Een mix van colleges, demonstraties, gesprekken en excursies, n.t.b. in de loop van de cursus.

### Toetsvorm

Voorwaarde vooraf: Aanwezigheid bij de colleges en excursies en meedoen bij de discussies is in principe verplicht. Wie vaak niet verschijnt en geen regeling heeft getroffen, wordt uitgesloten.

Je werkt gedurende het semester aan twee flinke architectuurstudies: één over een fysiek bouwwerk, een over een digitale. Voor beide krijg je een cijfer op basis van de schriftelijke uitwerking en een presentatie. Beide moeten voldoende zijn. Het eindcijfer is het gemiddelde van de twee cijfers.

### Vereiste voorkennis

Open blik en een zekere nieuwsgierigheid voor dingen die op het eerste gezicht misschien niets met IT te maken hebben.

### Literatuur

Elke deelnemer wordt geacht een aantal boeken over architecten en architectuurstromingen te bezitten. De Slegte heeft altijd interessante architectuurboeken voor een zachte prijs. Het komt niet aan op specifieke boeken, architecten, stromingen. Het doel is dat je een beeld hebt van fysieke architectuur.

### Website

<https://lab.cs.ru.nl/algemeen/Architectuur>

## Informatiesystemen (IS1)

Vakcode: **IBI003** 6 ec

eerste semester

dr. P. van Bommel

### Studielastverdeling

- 32 uur hoorcollege
- 32 uur werkcollege
- 104 uur zelfstudie

### Inleiding

Dit vak behandelt informatiemodellering, een essentieel onderdeel van systeemanalyse. Centraal staat de vraag hoe we op een nette en formele manier de syntax en de semantiek van informatiemodellen kunnen vastleggen. Er worden modelleringstechnieken besproken, die voldoen aan de volgende eisen. De techniek heeft een *formele* onderbouwing, is op een *conceptueel* nivo, heeft een ruime *expressieve* kracht, is *executeerbaar*, leidt tot begrijpelijke en *communiceerbare* modellen, en is geschikt voor het modelleren van *gegevensintensieve* domeinen. Communiceerbaarheid is een belangrijke eis, omdat conceptuele modellen een cruciale rol spelen in de communicatie met domeinexperts.

### Leerdoelen

In dit vak zul je leren hoe je het belang van formele methoden kunt argumenteren. Daarbij is het belangrijk dat je de *syntax en semantiek van informatiemodellen* zodanig leert begrijpen, dat je complexe domeinen kunt modelleren. Vervolgens leer je om te redeneren over *correctheid en consistentie* van informatiemodellen. Als er fouten in het model blijven zitten, zal het resulterende systeem niet aan de verwachtingen voldoen! Ook compleetheid van de modellen is belangrijk. Incomplete modellen hebben namelijk tot gevolg dat bepaalde aspecten nog niet gemodelleerd zijn, waardoor we helemaal niet meer weten hoe het uiteindelijke systeem zich zal gaan gedragen.

### Onderwerpen

- De syntax en semantiek van informatiestructuren kennen.
- Kunnen werken met populaties van informatiestructuren.
- Redeneren over type-gerelateerdheid.
- De syntax en semantiek van veel voorkomende constrainttypen kennen.
- Tegenspraken in constraints opsporen, uitleggen en bewijzen.
- Meta modellen kunnen maken.
- De complexiteit van verificatie van modellen kennen.
- De syntax en semantiek van padexpressies kunnen begrijpen en toepassen.

### Toelichting werkvormen

Het is de bedoeling dat je na elk *hoorcollege* je aantekeningen bestudeert en in het dictaat de betreffende onderdelen leest. Je kunt dan de volgende keer vragen stellen over onderwerpen die je nog niet goed begrijpt. Op het *werkcollege* worden opgaven besproken. Het werkcollege heeft een sterk interactief karakter. Alle studenten worden daarbij aangesproken.

Naast het hoorcollege en het werkcollege moet je een *werkstuk* maken. Dat gebeurt gefaseerd. Elke drie weken moet je een tussenversie van je werkstuk inleveren. Als je de tussenversie met de docent wil bespreken, wordt er een afspraak ingepland. Je krijgt dan tips hoe je je werkstuk verder kunt verbeteren.

### Toetsvorm

Individueel werkstuk (w) en centraal schriftelijk tentamen (t). Het werkstuk is een verplicht onderdeel. Het telt mee voor 20 procent. Het eindcijfer (e) wordt als volgt bepaald: IF  $t < 5$  OR  $w < 5$  THEN  $e = \min(t, w)$  ELSE  $e = 0.2 * w + 0.8 * t$ .

### Vereiste voorkennis

Het is handig als je al wat ervaring hebt met informatiemodellen. Dat kan bijvoorbeeld door het vak *Domeinmodellering* te volgen (of een vergelijkbaar vak). Verder is het handig als je een beetje kunt omgaan met wiskundige definities. Het vak *Beweren en bewijzen* kan je daarbij helpen (of een vergelijkbaar vak).

### Literatuur

- Het *dictaat*.
- Instructies voor het *werkstuk*.
- *Handbook of data modelling* (van 1959 tot 2008).
- Suggesties voor *further reading* (niet verplicht).

## Modelleren van Bedrijfsprocessen

Vakcode: IPK007 3 ec

vierde kwartaal

drs. G.F.M. Paulussen

### Studielastverdeling

- 14 uur hoorcollege
- 14 uur werkcollege

### Inleiding

In deze cursus krijgen studenten inzicht in de vraag hoe bedrijfsprocessen en hun organisatorische context gemodelleerd kunnen worden. Daarnaast maken de studenten kennis met een fundamentele kijk op modelleren.

### Leerdoelen

Na afloop van de cursus is de student is in staat om:

- een waardemodel voor de omgeving van een organisatie op te stellen,
- een transactiemodel voor een organisatie op te stellen,
- een bedrijfsprocesmodel op te stellen dat de uitvoering van de transacties nader uitwerkt,
- de validiteit van een procesmodel te beargumenteren

### Onderwerpen

Onderwerpen die aan bod zullen komen hebben betrekking op:

1. fundamenten van het modelleren;
2. value modellering met e3value;
3. transactiemodellering middels DEMO en ArchiMate;
4. modelleren van bedrijfsprocessen middels BPMN;
5. semantiek van bedrijfsprocessen in termen van petri netten en proces algebra;
6. mapping naar UML en verdere implementatie-stappen.

### Toelichting werkvormen

Naast de theorie is er een (kleine) casus opgenomen met 2 stappen. zodat tussendoor feedback mogelijk is:

1. analyseer de bestaande werkstromen, maak een bedrijfsprocesmodel, voer een analyse uit op dit model en stel verbeteringen voor.
2. mapping naar UML en verdere implementatie/stappen

### Toetsvorm

Naast een (kleine) casus, wordt de cursus getoetst via een tentamen.

**Vereiste voorkennis**

Domeinmodellering

**Literatuur**

Reader in de vorm van PDFs

## Onderhandelen en veranderen (het communicatieproces)

Vakcode: **IBK004 3 ec**

tweede semester

dr. J.J. Sarbo

### **Studielastverdeling**

- 20 uur hoorcollege
- 8 uur werkcollege
- 56 uur zelfstudie

### **Inleiding**

In deze cursus maken studenten kennis met de theorie en praktijk van het onderhandelingsproces. Deze materie wordt belicht vanuit communicatief perspectief, met aandacht voor mensgerelateerde aspecten van communicatie, onderhandelen en besluitvorming. Er wordt echter ook uitgebreid stil gestaan bij de basale formeel-wiskundige achtergronden van deze processen. Hierbij wordt o.a. aandacht besteed aan beslissingstheorie en speltheorie. Naast enige oefeningen wordt een tweeweekse on-line casus gespeeld met behulp van een webgebaseerd onderhandel-support systeem.

### **Leerdoelen**

Na afloop van de cursus is een student in staat om

- in een concrete situatie te redeneren over het onderhandelingsdomein;
- verschillende onderhandelingsstrategieën te duiden, en de toepasbaarheid in een gegeven onderhandelingssituatie te argumenteren;
- in afgebakende situaties onderhandelingen te voeren tussen verschillende stakeholders van een te ontwikkelen en in te voeren systeem.
- de theorie en praktijk van onderhandelen en besluitvorming te relateren aan en formeel te onderbouwen met modellen op het gebied van beslissingstheorie en speltheorie.

### **Onderwerpen**

Onderwerpen die in het toepassingsgerichte deel van de cursus aan bod komen zijn o.a.: strategisch communiceren, de machtsbalans, minimax en maxima, het verschil tussen standpunten en belangen, het ontwikkelen van flexibiliteit. Ook wordt aandacht besteed aan: beslissingstheorie, speltheorie en de formele analyse van onderhandelingssituaties.

### **Toelichting werkvormen**

De voornaamste werkform is het klassieke hoorcollege (met een interactief tintje). Er wordt echter ook geoefend, in groepen maar zeker ook per individu. Dat gebeurt face-to-face, maar ook on-line.

### **Toetsvorm**

- Praktijk: elke student dient tenminste eenmaal te participeren in de rollenspelen waarin concrete onderhandelingssituaties worden nagespeeld. Daarnaast is er een schriftelijke casus als inleveropdracht.

- Theorie: schriftelijk tentamen.

De uitslag wordt vastgesteld op basis van het gemiddelde van de twee schriftelijke onderdelen. Participatie in de praktijkopdrachten draagt in de vorm van een bonus- of afrondingsregeling bij aan het eindcijfer.

### **Vereiste voorkennis**

Formeel denken

### **Literatuur**

Reader/Syllabus: Onderhandelen en Veranderen.

Fisher, R., Ury, W. and Patton, B.: Excellent Onderhandelen (Business Contact, Amsterdam/ Antwerpen. 2006.) ISBN 90-254-0113-9.

Howard Raifa: Negotiation Analysis (Belknap Press, Cambridge, Mass. 2002). ISBN-10 0-674-02414-1

## Onderzoeksmethoden

Vakcode: **IBI007 3 ec**

eerste semester

prof. dr. E. Barendsen  
dr. I. Wilmont

### Studielastverdeling

- 2 uur groepsgewijs college
- 22 uur hoorcollege
- 24 uur projectwerk
- 16 uur werkcollege
- 20 uur zelfstudie

### Inleiding

Deze cursus gaat over het voorbereiden en het uitvoeren van onderzoek. We vatten de term 'onderzoek' daarbij breed op:

- problemen signaleren, analyseren en oplossen
- aan de hand van een precies geformuleerde *onderzoeksraag*
- uitgevoerd met verantwoorde *methoden*
- zodanig dat het resultaat betrouwbaar is.

Wat is wetenschappelijk onderzoek? Hoe kom je van een vaag probleem tot een goede onderzoeksraag? Hoe werkt de wetenschappelijke wereld? Aan de hand van deze vragen gaan we in deze cursus samen op verkenning.

We werpen een kritische blik op voorbeelden van onderzoek en verslaggeving daarover in de media. Je leert eigen onderzoek te ontwerpen en enkele veelgebruikte methoden in te zetten.

### Leerdoelen

Na afloop van deze cursus kunnen de deelnemers:

- professionele criteria aangeven voor ontwerp en uitvoering van onderzoek; deze criteria toetsen in praktijksituaties; kritisch reflecteren op (publicaties over) onderzoek;
- onderzoeksraag formuleren;
- literatuur zoeken met professionele hulpmiddelen, literatuurbeschrijvingen opstellen;
- operationaliseren; onderzoeksmodellen (theoretisch, empirisch) opstellen;
- veelgebruikte methoden voor dataverzameling beschrijven, aangeven in welke situaties ze toepasbaar zijn en hoe valkuilen te vermijden zijn;
- methoden voor kwalitatieve en kwantitatieve analyse karakteriseren;
- in het kader van een onderzoeksontwerp een passend onderzoeksinstrument (vragenlijst, interview, tekstanalyse, experiment) ontwikkelen
- een onderzoeksplan opstellen volgens een professioneel format;
- de gekozen aanpak verdedigen tegenover collega-onderzoekers.

### Onderwerpen

- Inleiding: onderzoeksdesigns, criteria voor onderzoek
- Onderzoeksontwerp: onderzoeksraag, elementen van een onderzoeksplan, professionele standaarden

- Wetenschap: de wetenschappelijke wereld, mores, publicaties, literatuur zoeken, bibliotheek, wetenschapsfilosofie
- Onderzoeksstrategieën: kwantitatief en kwalitatief onderzoek, karakteristieken, dataverzameling en data-analyse
- Operationaliseren: onderzoekseenheden, variabelen, meetniveaus, indicatoren, steekproefkaders, selectie van onderzoekseenheden, externe validiteit, interne validiteit, validiteit van causale verbanden
- Specifieke methoden: vragenlijsten, interviews, tekstanalyse (content analysis, kwalitatieve analyse), experimenten

### **Toelichting werkvormen**

Via interactieve colleges met veel voorbeelden leer je methodologische aspecten van onderzoek kennen. Je werkt in de loop van de cursus aan een onderzoeksplan en ontwikkelt een bijpassend onderzoeksinstrument. Wekelijkse werkgroepbijeenkomsten ondersteunen dit stapsgewijs. Voor deelname aan de werkgroepen is voorbereiding noodzakelijk. Je geeft feedback aan medestudenten, waarbij je oefent met de professionele wetenschappelijke criteria. Je verdedigt je onderzoeksontwerp in een presentatie.

### **Toetsvorm**

De beoordeling wordt bepaald op grond van:

- het onderzoeksplan en het ontwikkelde onderzoeksinstrument;
- de presentatie.

Om voor beoordeling in aanmerking te komen, moet je hebben meegedaan aan de onderlinge feedback ('peer review').

### **Vereiste voorkennis**

De studenten kunnen:

- schriftelijk en mondelijk helder formuleren;
- teksten schrijven in adequaat Nederlands;
- elementen van de taal van propositie- en predicaatelogica herkennen in natuurlijke taal (zoals in de cursus *Formeel denken* en de cursus *Beweren & bewijzen*)

### **Literatuur**

A. Bryman (2008), *Social research methods*, third edition, Oxford University Press, ISBN 978-0-19-920295-9

### **Website**

<https://lab.cs.ru.nl/algemeen/Onderzoeksmethoden>

# Requirements Engineering

Vakcode: IPK009 6 ec

tweede semester

dr. S.J.B.A. Hoppenbrouwers

## Studielastverdeling

- 20 uur groepsgewijs college
- 30 uur hoorcollege
- 6 uur individuele begeleiding
- 40 uur projectwerk
- 72 uur zelfstudie

## Inleiding

Een inleiding in de "Requirements Engineering" (RE): een kernactiviteit in systeemontwikkeling die neerkomt op het vergaren en zorgvuldig specificeren van de eisen en verwachtingen die diverse stakeholders (opdrachtgevers, toekomstige gebruikers) hebben met betrekking tot een te bouwen informatiesysteem. We bestuderen en oefenen een methodiek waarin Use Cases centraal staan, maar waarbij diverse informele en formele modellen en beschrijvingen integraal worden opgesteld. Daarbij spelen bijv. ook conceptuele domeinmodellen en Business Rules een rol. Een uitgebreide projectcasus maakt deel uit van de cursus.

## Leerdoelen

Na afloop van de cursus kunnen de deelnemers:

- Requirements vergaren en goedend specificeren
- Goed kwaliteit requirements integraal formuleren middels een aantal technieken, waaronder use cases, scenarios, domeinmodellen, business rules
- Projectmatig omgaan met het proces van RE
- Reflecteren op RE in zowel theoretische als toegepaste zin, en in context van systeemontwikkeling als geheel

## Onderwerpen

- Wat zijn requirements (why-what-how van een systeem; functioneel and non-functioneel)
- Requirements vergaren
- Specificeren van requirements
- Fasering en planning in RE
- Use Cases
- Scenarios
- Business rules
- Domein modellen
- Stakeholder Analyse
- Requirements en taal
- RE in de praktijk

### Toelichting werkvormen

Er zijn reguliere colleges en daarnaast een groot project (groepsgewijs). In het begin, voor het project uit, zijn er nog enkele werkcolleges.

De hoorcolleges (inclusief enige gastcolleges) behandelen het vaste leerboek van de cursus, maar ook een aantal uitbreidingen daarop. Al met al wordt een aantal integrale beschrijvingen en modellen aangeboden en uitgelegd, en daarnaast een uitgebreide werkwijze, alsmede de filosofie daarachter.

Het project wordt gecommuniceerd via de elektronische werkplaats. Het bestaat uit drie fases (iteraties). Er wordt altijd een semi-realistische casus gedaan: de requirements van een heus informatiesysteem met een echte "opdrachtgever", alleen niet in een commerciële setting. Het project wordt afgesloten met een rapport en een presentatie.

### Toetsvorm

Deelnemers doen een schriftelijk examen (open vragen), maar het project telt ook zwaar mee: zwaarder zelfs dan het schriftelijk.

### Vereiste voorkennis

Propedeuse Informatiekunde, met nadruk op de cursus domeinmodelleren. Voor schakelvakkers: een vorm van conceptueel modelleren, bijv. FCO-IM, ORM, of ER. UML kennis is ook handig, m.n. Use Cases en Class Diagrams. Er wordt in ieder geval basiskennis verwacht van het algemene proces van systeemontwikkeling.

### Literatuur

Centraal staat het leerboek "Use Cases - requirements in context" (Kulak en Guiney, 2003; 2nd edition; Addison-Wesley; ISBN 0-321-15498-3). Dit is verplichte literatuur. Overig materiaal (o.a. een syllabus) wordt digitaal aangeboden via de website.

### Website

Wiki werkplaats

## Security

Course ID: **IBI002** 6 ec

prof. dr. B.P.F. Jacobs

dr. F.D. Garcia

ir. P. Vullers

### Study investment

- 32 hrs lecture
- 32 hrs problem session
- 104 hrs individual study period

### Introduction

Security is widely recognized as being of great importance in all areas of information technology: networks, operating systems, databases etc. Security is about regulating access to assets. Crucial questions are: Who are you? and: Should you be doing that? Authentication (of people and computers) and access control are basic aspects of computer security.

Cryptography provides a mathematical toolset for realising key security goals, via appropriate protocols.

This bachelor lecture introduces the basics of computer security, both for computer science and information science students.

### Objectives

At the end of this course:

1. You are able to recognise -- in society in general and within a job environment in particular -- situations in which information security plays a role.
2. You are able to recognise relevant security goals in such situations (confidentiality, integrity, availability, authenticity, non-repudiation, accountability).
3. You can (on a global level) describe basic techniques to achieve these security goals, evaluate existing solutions, and propose new solutions in practical situations.
4. You recognise the social and organisational implications of security technologies (especially privacy), and you can take these aspects into account in your analysis of practical situations.

### Subjects

- Elementary cryptography
- Symmetric key encryption
- Public key encryption
- Digital signatures
- Management of public keys
- Communication security
- Authentication protocols
- E-mail security
- Web security
- Social issues

**Teaching methods**

The course consists of weekly lectures and exercises. The exercises are compulsory, and make up half of your final mark. Exercises may be done in pairs. Your solution has to be handed in on paper before the deadline, at in the mailbox of your exercise course teacher on the 2nd floor of the Huygens building. Exercises not handed in in time will be graded 1; submission by e-mail or Blackboard is not accepted. Copying or stealing work from others or from the Web will result in all involved parties failing the course and notification of the exam committee, so make sure we don't discover anything if you copy yourself, and secure your own work against copying by others.

**Examination**

The examination will be based on the outcome of both the exercises and the written exam. If both parts (exercises and exam) of the examination have been completed in time, the final mark will be the average of the two, provided the outcome of the exams is at least 5.0. If the result of the exam is lower than 5.0, the final mark will be equal to this result.

You are *not* allowed to bring books or notes to the written exams. The grade for the exercises is valid until the first retry exam. If you do not finish the course within this academic year, you will have to do the exercise course again next year.

**Prerequisites**

Basic knowledge of computer science and mathematics (esp. algebra).

**Extra information**

As of 2009 this course exists only in 6ec form.

## Statistiek voor Informatiekunde

Vakcode: **IBK007 3 ec**

eerste semester

dr. J.D.M. Maassen

### Studielastverdeling

- 10 uur computerpracticum
- 14 uur hoorcollege
- 18 uur werkcollege
- 42 uur zelfstudie

### Inleiding

In deze cursus gaat het om beschrijvende en verklarende statistiek met het oog op het hanteren van kwantitatieve gegevensverzamelingen.

### Leerdoelen

De student is op de hoogte van de diverse soorten van variabelen. Hij kan dataverzamelingen analyseren en grafisch weergeven, daarbij ondersteund door een statistisch pakket (Excel of SPSS). Hij kan kansverdelingen herkennen en benoemen. Hij is op de hoogte van diverse statistische toetsen en van de voorwaarden waaronder deze van toepassing zijn. Hij kan aan de hand van operationalisatie een geschikte statistische methode selecteren, en is in staat de interne consistentie van een operationalisatie te onderzoeken. Hij weet met welke factoren bij de opzet van een onderzoek rekening moet worden gehouden.

### Onderwerpen

Geplande onderwerpen:

- Beschrijvende statistiek
- Waarschijnlijkheid
- Stochastische variabelen
- Steekproeven
- Betrouwbaarheidsintervallen
- Toetsing van hypothesen
- Vergelijking van populaties
- Opzetten van experimenten
- Regressie

### Toelichting werkvormen

hoorcollege, werkcollege, computerpracticum en zelfstudie

### Toetsvorm

Schriftelijk tentamen.

**Vereiste voorkennis**

Wiskunde 1 voor kunstmatige intelligentie (BKI 116) of de combinatie van cursussen Wiskunde 1 (IPI007) en Wiskunde 1a (BKI104)

**Literatuur**

- Dictaat verspreid via Blackboard.
- Achtergrond: Larry Gonick en Woollcott Smith, Het stripverhaal van de statistiek. Epsilon Uitgaven Utrecht deel 32 (1994).
- Achtergrond: A. Buijs, Statistiek om mee te werken. Stenfert Kroese 1993.

## Wiskunde 1

Vakcode: **IPI007** 3 ec

derde kwartaal

prof. dr. B.P.F. Jacobs  
dr. L. Batina  
dr. O. Shkaravská  
drs. K. Madlener

### Studielastverdeling

- 16 uur hoorcollege
- 16 uur werkcollege
- 52 uur zelfstudie

### Inleiding

Basis wiskunde kennis voor Informatica, Informatiekunde en Kunstmatige Intelligentie. Onderwerpen uit de lineaire algebra worden behandeld.

### Leerdoelen

Na afloop is de student bekend met begrippen uit de Lineaire Algebra zoals matrixrekenen en eigenwaarden, en kan hij hiermee werken.

### Onderwerpen

- stelsels lineaire vergelijkingen
- vectorruimten, lineaire afbeeldingen
- vermenigvuldiging van matrices, inverse van een matrix
- eigenwaarden, eigenvectoren
- inproducten

### Toelichting werkvormen

hoorcolleges, huiswerkopdrachten en werkcolleges ter besprekking van de opdrachten

### Toetsvorm

Schriftelijk tentamen

### Vereiste voorkennis

geen

### Literatuur

dictaat, beschikbaar op: [http://www.math.ru.nl/~souvi/wiskunde1\\_07/linalg.pdf](http://www.math.ru.nl/~souvi/wiskunde1_07/linalg.pdf)

### Bijzonderheden

geen

## Mathematics 1A

Course ID: **BKI104** 3 ec

2nd semester

dr. F.A. Grootjen

## 4 Appendices

### 4.1 Calendar 2010-2011

**Academic year:**

August 30 2010 - August 31 2011

Yearly, the education is scheduled within four periods of 10 weeks:

- 8 weeks for scheduled courses
- 2 weeks (the last two weeks) for exams.

**Semester:**

Fall semester: Monday 30 August 2010 - Friday 28 January 2011;

Spring semester: Monday 31 January - Friday 15 July 2011.

**Holiday(s):**

During holidays there are no lectures, but it is possible that exams and preliminaries are scheduled during holidays. For more information please consult the schedule below.

**Please note:** there is no scheduled Fall break this year because this would be adjacent to the first quarter break, and therefore result in a course free period of three weeks.

Holiday	Date	Lectures	preliminaries	exams
Opening of the academic year	afternoon 30-08-10	-	-	-
Christmas holidays	20-12-2010 / 31-12-2010	-	-	-
Carnival	07-03-2011 / 11-03-2011	-	+	-
Easter	22-04-2011/ 25-04-2011	-	-	-
May holiday	02-05-2011 / 06-05-2011	-	+	-
Queen's Birthday	30-04-2011	-	-	-
Liberation Day	05-05-2011	-	-	-
Foundation Day ("Dies")	19-05-2011	-	-	-
Ascension day	02-06-2011	-	-	-
day after Ascension day	03-06-2011	-	-	-

Whitsun	13-06-2011	-	-	-
Summer holidays	18-07-2011 / 26-08-2011			
		-	-	-
	18-07-2011 /	-	+	-
	11-08-2011	-	+	+
	15-08-2011 /			
	19-08-2011			
	22-08-2011 /			
	26-08-2011			

**Quarters:**

Quarter 1:	30-08-2010 till 05-11-2010
Quarter 2:	08-11-2010 till 28-01-2011
Quarter 3:	31-01-2011 till 15-04-2011
Quarter 4:	18-04-2011 till 15-07-2011

## 4.2 Important names and addresses

**Faculty of Sciences**

Heyendaalseweg 135, 6525 AJ Nijmegen  
 Huygens building  
 tel.: 024-3616161 (Radboud University - general phone nr.)

**Education Bureau for Computing and Information Sciences**

- Staff:

*Ms.mr. Resi Westerman*, pr/secretary; R.Westerman@cs.ru.nl

*Ms. Marcha Jelissen*, pr/secretary; M.Jelissen@cs.ru.nl

*Ms.drs. Vera Kamphuis*, head, coordinator of studies of Information Science;  
 V.Kamphuis@cs.ru.nl

*Ms. Yella Kleijnen*, coordinator of studies of Computing Science; Y.Kleijnen@cs.ru.nl

- Secretary's office: HG02.540, Huygens building, tel.: 024-3652084

N.B.: In the course of the academic year, presumably in January 2011, the Education Bureau will move to the new Education Centre on the ground floor of the Huygens Building (wing 5).

**Student advisor for Master students**

- *dr. Theo Schouten*, T.Schouten@cs.ru.nl

**Student advisor for "HBO-instromers" (post-Polytechnic bachelor students)**

- *dr. T.Schouten*, T.Schouten@cs.ru.nl

### **Master's thesis coordinator**

- *Dr. Patrick van Bommel*, [pvb@cs.ru.nl](mailto:pvb@cs.ru.nl)  
website: [www.cs.ru.nl/mlt/](http://www.cs.ru.nl/mlt/)

### **Education Board**

- *Prof.dr.Herman Geuvers*, director; [H.Geuvers@cs.ru.nl](mailto:H.Geuvers@cs.ru.nl)
- *Dr. Sjaak Smetsers*, coordinator of the master programme Computing Science; [S.Smetsers@cs.ru.nl](mailto:S.Smetsers@cs.ru.nl)
- *Prof.dr.Th.P.van der Weide*, coordinator of the master programme Information Science; [Th.P.vanderweide@cs.ru.nl](mailto:Th.P.vanderweide@cs.ru.nl)
- *Ms. Vera Kamphuis, MA*, head of the education office; [V.Kamphuis@cs.ru.nl](mailto:V.Kamphuis@cs.ru.nl)
- *Ms. Yella Kleijnen*, secretary; [Y.Kleijnen@cs.ru.nl](mailto:Y.Kleijnen@cs.ru.nl)
- *Royce Benda*, studentassessor; [assessor@cs.ru.nl](mailto:assessor@cs.ru.nl)
- *Xander Damen*, studentassessor; [assessor@cs.ru.nl](mailto:assessor@cs.ru.nl)

### **Education Committee of Computing Science and Information Science**

Members of this committee are 4 students in computing science, 4 students in information science and 4 lecturers.

- *Drs. Ger Paulussen*, chairman; [G.Paulussen@cs.ru.nl](mailto:G.Paulussen@cs.ru.nl)
- *Ms. Yella Kleijnen*; secretary; [Y.Kleijnen@cs.ru.nl](mailto:Y.Kleijnen@cs.ru.nl)

### **Examination Board**

General e-mail account: [examencommissie@niii.ru.nl](mailto:examencommissie@niii.ru.nl)  
Website: [www.cs.ru.nl/examencommissie/index.html](http://www.cs.ru.nl/examencommissie/index.html)

### **Coordinator of international affairs for Computing and Information sciences**

- *Prof.dr. Th.P.van der Weide*, [Th.P.vanderweide@cs.ru.nl](mailto:Th.P.vanderweide@cs.ru.nl)

### **Office of administration and exams for students (FSA)**

This academic year, presumably in January 2011, the FSA will move to the new Education Centre in the Huygens building. Further announcements will follow.

- Ms. Clementine Hendriks, Ms. Yvonne Mulder,  
opening hours: Monday to Thursday: 13-16 hrs, Friday: 9-12 hrs  
room: HG00.134, Huygens building (the FSA will also move in 2011)  
tel.: 024-3652247/024-3653392

### **Student affairs office**

- Comeniuslaan 4, Nijmegen  
tel.: 024-3612345  
webpage: [www.ru.nl/students/](http://www.ru.nl/students/)

### **Students' association Thalia (for students of Computing Science or Information Science)**

- [info@thalia.nu](mailto:info@thalia.nu) (general info)  
website: [www.thalia.nu/](http://www.thalia.nu/)

### **Alumni association Ninja (for Computing and Information Sciences)**

- website: [www.cs.ru.nl/ninja/](http://www.cs.ru.nl/ninja/)

## **4.3 Procedure for "Schakelverklaringen"**

This information is intended for students who enter the master programme on the basis of a Bachelor's degree from a Polytechnic ("HBO-doorstromers"). Such students need to complete a set of courses from the bachelor programme covering their deficiencies (transition programma or in Dutch "schakelprogramma") before being able to register as master students. For reasons of planning, the courses of the deficiency programme may be intertwined with the courses of the master programme, which means that you are in fact allowed to take part in a few basic courses of the master programme before actually completing the deficiency programme. However, **you are not entitled to start work on your master's thesis until you have completed your "schakelprogramma" and are officially registered as master student.** In order to register as master student, you need to obtain a so-called "Schakelverklaring" from the Education bureau. Here's how (in view of the fact that HBO-doorstromers are usually Dutch, we shall describe this in Dutch below).

### **Procedure voor schakelverklaringen (no unsatisfactory marks allowed):**

- naam-, ru-email-, adres- en opleidingsgegevens.
- Het bewijs dat je ingeschreven staat voor de bacheloropleiding Informatica. Daarvoor lever je een kopie van je collegekaart in.
- Een uitdraai van je cijferlijst. Hierop mag geen onvoldoende staan. De cijferlijst vraagt je op bij de facultaire studentenadministratie (HG0.134) en is voorzien van handtekening en stempel van de FSA (openingstijden ma-do: 13-16 uur, vrij 9-12 uur). Geef zelf even aan om welke cursussen het gaat (aanvinken of markeren met stift).
- Je kunt je gegevens inleveren bij het onderwijsbureau. Als er niemand aanwezig is dan kun je je gegevens in de brievenbus naast de deur doen. Het wijst zich vanzelf

welke dat is.

5. Je levert bij het onderwijsbureau de volgende gegevens in:
6. Het onderwijsbureau controleert je gegevens, overlegt met de examencommissie en bereidt de verklaring voor.
7. Je krijgt de verklaring binnen twee weken thuis gestuurd.
8. Met deze verklaring moet je zelf bij de centrale studentenadministratie (Comeniuslaan 4) je inschrijving omzetten.  
**JE KUNT PAS MET JE AFSTUDEREN BEGINNEN ALS DE INSCHRIJVING IS OMGEZET EN JE ALS MASTERSTUDENT STAAT GEREgistreerd.**

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