Turku Centre for Computer Science

# Annual Report 2000 - 2001

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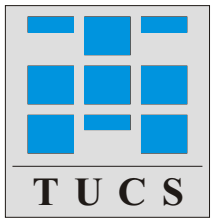


Turku Centre for Computer Science

TUCS General Publication

No 23, April 2003

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# 1 Introduction

The Turku Centre for Computer Science (TUCS) is a joint research and education centre between the University of Turku, Åbo Akademi University and the Turku School of Economics and Business Administration. From the beginning of year 2000 it has been an independent department of the three universities. At the same time it got new statutes.

TUCS coordinates research and education in the field of Information Technology. These activities are carried out in the TUCS Master's and Graduate Schools and in the centre's own research groups/laboratories. During the years 2000 and 2001 TUCS has taken an active role in the coordination of the Master of Science in Engineering studies as well as the professional upgrading program.

TUCS has published its Annual Report yearly starting from 1996. Due to changes in personnel, the report of year 2000 was not published at due time, and in the spring 2002 it was decided that a combined Annual Report for the years 2000 and 2001 will be published that the series would not break off. The editorial staff thanks everybody involved in gathering the material for this report.

## 1.1 Overview

Turku Centre for Computer Science (TUCS) is a joint research and education centre between the three universities in Turku, Finland: the University of Turku, Åbo Akademi University, and the Turku School of Economics and Business Administration. TUCS coordinates research and education in the field of Information Technology. These activities are carried out in the TUCS Graduate School and in the centre’s research groups/laboratories. The main areas of research are Algorithmics, Discrete Mathematics, Electronics and Communication Systems, Embedded Systems, Information Systems, Software Engineering, and Mathematical Modeling.

TUCS was started in March 1994, in cooperation between the three universities. The purpose was to combine the research, the advanced level teaching and the Ph.D. education of the participating departments into a joint research centre, with a Graduate School as a central component. The first students started at the TUCS Graduate School in September 1994. In the end of 2001, TUCS had 87 full time Ph.D. students.

From the very start TUCS has had a strong international profile. The working language in many research groups/laboratories is English, and all Graduate School courses are taught in English. TUCS has an extensive international recruitment of Ph.D. students, postdoctoral researchers and senior researchers. As a consequence, most postdoctoral researchers and a large number of TUCS Ph.D. students come from abroad.

TUCS has presently 16 research laboratories, with research spanning from theoretical basic research in Computer Science and Discrete Mathematics to computer applications in industrial and business information systems. The research laboratories are involved in a number of more specific research projects, mostly with external funding from the Academy of Finland (basic research), TEKES (industrial applied research), or direct funding from industry. The supervision of Ph.D. students is done within these research laboratories.

Besides having a graduate school with common courses and seminars, TUCS also coordinates research activities of the participating departments. It organizes scientific conferences,

workshops and summer schools. It publishes a joint technical report series, Ph.D. theses and conference proceedings, as well as a National Publication Series. TUCS publications are all available on the World Wide Web for immediate downloading and inspection. The web also provides the most updated and detailed information about TUCS, its daily activities and its accumulated results (the web address is www.tucs.fi).

## 1.2 The Development of TUCS 1994-2001

All three universities in Turku have departments in the areas covered by TUCS, and the need for cooperation was evident for a long time. As a fist step, the departments moved into common localities in DataCity, in 1988. This was the first part of the Turku Technology Centre to be built. The technology centre is now at least three times bigger, with newer buildings devoted to Biotechnology, Electronics and Material Sciences.

The next step was the forming of a joint graduate school in Computer Science between the departments that were situated in DataCity. The initiative for forming the graduate school was taken in August 1993, and a small workgroup was set up to plan the school. The workgroup made quick progress, and the Turku Graduate School in Computer Science was formed in November 1993. After discussions with the Academy of Finland, it was decided that the scope of activities should be expanded to a full research centre, and that the Graduate School was to be a part of this research centre. The Turku Centre for Computer Science, abbreviated TUCS, was consequently formed in February 1994.

The working language of TUCS was chosen to be English. This was a way of solving the problem of combining research and teaching at three universities with two different teaching languages, Finnish at the University of Turku and at the Turku School of Economics and Business Administration and Swedish at Åbo Akademi University. Even more important however was the desire to make TUCS into a truly international research centre. This has also succeeded, to an extent that was not really even foreseen in the beginning, with all TUCS courses now being lectured in English, a large part of the Ph.D. students (40%) coming from abroad, and quite a number of foreign postdoctoral researchers and more senior researchers visiting TUCS for longer periods. During the years 2000-2001 TUCS had postdoctoral researchers e.g. from Yugoslavia, China, Spain and the Czech Republic.

TUCS was a pilot project that received special support from the Ministry of Education in its first two years. Organizing Ph.D. studies in the form of a Graduate School was new in Finland, as was also the extensive cooperation between three different universities. The TUCS Graduate School was the first one to start in Finland. The graduate school model was considered very successful by the Ministry of Education, who decided to go for it wholeheartedly. In the next two years, altogether 93 graduate schools were formed in Finland, in all areas of science. There are now four other graduate schools in Computer Science besides TUCS: HECSE in Helsinki, TISE in Tampere, COMAS in Jyväskylä and ECSE in Eastern Finland (Joensuu, Lappeenranta, and Kuopio). TUCS has acquired its own share of the full-time Ph.D. student positions that were allocated to the new graduate schools. In 1995 10 positions were allocated to TUCS. In 1998, TUCS got 10 additional Ph.D. student positions, and from January 1999 TUCS has had 24 Ph.D. student positions financed by the Ministry of Education.

In 1995 TUCS was selected as a Centre of Excellence in research by the Academy of Finland. This was recognition of the strong research carried out by the research groups at TUCS. The research groups of Prof. Arto Salomaa in formal languages and cryptology at the University of Turku and the research group of Prof. Ralph-Johan Back in programming methodology at the

Åbo Akademi University were specifically mentioned. The combined research strength of TUCS gave it the Centre of Excellence status also in the following years (1996-1999).

TUCS research groups have recruited many Ph.D. students in 1994-2001. This has been possible through the additional funding by the Ministry of Education, the Centre of Excellence funding and external research projects. As the average time for completing a Ph.D., even in favorable circumstances, is 4 - 6 years, the increase in Ph.D. student enrolment has not, until recent years, started to show in the annual production of Ph.D. and Ph.Lic. degrees. TUCS has produced a total of 51 Ph.D. degrees and 38 Ph.Lic. degrees since its start in 1994. In 2000-2001 TUCS produced 17 Ph.D. degrees and 5 Ph.Lic. degrees.

TUCS has a number of postdoctoral grants available primarily for researchers that have recently completed their Ph.D. thesis. The grants have attracted quite a number of young and very talented researchers, mostly from abroad, who have made significant contributions to the research carried out in the research groups/laboratories. They have also contributed to a very good working environment and have served as role models for Ph.D. students.

## 1.3 Organization

The education and research activities are carried out within the Graduate School and the Research Laboratories. Decisions are primarily made in the TUCS board. Planning and execution is carried out in the workgroups, Graduate School Committee and the Advisory Committee. By the end of 2001 there were about 30 professors, 30 Ph.D. level researchers and 87 doctoral students at TUCS, which is located in the Turku Technology Centre.

The following departments participate in TUCS and its Graduate School:

University of Turku
- Department of Mathematical Sciences
  - Computer Science
  - Mathematics
- Department for Applied Physics
  - Electronics and Telecommunication

Åbo Akademi University
- Department of Computer Science
- Institute for Advanced Management Systems Research

Turku School of Economics and Business Administration
- Department of Management
  - Institute of Information Systems Science

### 1.3.1 Director, Vice-director and the TUCS Board

The board is the organ with the highest authority in TUCS. The board is led by the chairman (and the vice-chairman). The director of TUCS (and the vice-director) are responsible to the board, and are responsible for the activities of TUCS. Board meetings are held once each month on an average.

*Director*: Professor Ralph-Johan Back
*Vice-director*: until May 31st, 2000, Professor Timo Järvi, followed by Professor Tapio Salakoski.

The board of the Turku Centre for Computer Science consists of professors from the participating departments, students, and local IT enterprises. During the years 2000-2001 the board has had the following members:

- *Chairman*: Professor Timo Järvi, University of Turku, Dept. of Computer Science (deputy member Professor Markku Nurminen)
- *Vice-chairman*: Professor Reima Suomi, Turku School of Economics and Business Administration, Institute of Information Systems Science (deputy member Professor Hannu Salmela).
- Professor Christer Carlsson, Åbo Akademi University, Institute for Advanced Management Systems Research (deputy member Professor Barbro Back).
- Managing director Tarmo Hahto, Janton Oyj (deputy member Teemu Hovi, Tekes)
- Ph.D. student Jeanette Heidenberg, Åbo Akademi University (deputy member Ph.D. student Ivan Porres Paltor)
- Professor Jouni Isoaho, University of Turku, Department of Applied Physics (deputy member Professor Risto Punkkinen)
- Professor Juhani Karhumäki, University of Turku, Department of Mathematics (deputy member Professor Mats Gyllenberg)
- M.Sc. student Jani Kupila, University of Turku (deputy member M.Sc. student Markus Turunen)
- M.Sc. student Henri Latvanen, Turku School of Economics and Business Administration (deputy member M.Sc. student Jenni Vuorio)
- Professor Kaisa Sere, Åbo Akademi University, Department of Computer Science (deputy member Associate Professor Johan Lilius)
- Professor Joakim von Wright, Åbo Akademi University, Department of Computer Science (deputy member Professor Aimo Törn)

### 1.3.2 Educational Workgroups

The administrative work at TUCS is partly organized through workgroups. There are three educational workgroups whose preliminary task is to coordinate the education in their field: the Computer Engineering workgroup, the Computer Science workgroup and the Information Systems workgroup. The educational workgroups consist of teachers and professors from the participating departments, student representatives, and administrative staff. The workgroups arrange about five meetings per year.

### 1.3.3 Graduate School Committee

The Graduate School committee handles most of the questions regarding the GS. The main responsibilities are the handling of study reports, the evaluation of Ph.D. applicants and deciding about principles concerning the supervision of students. The members of the Graduate School committee are professors (and supervisors) from the participating departments. The Committee is headed by Professor Juhani Karkumäki.

### 1.3.4 Professional Upgrading Program Workgroup

The aim of the Professional Upgrading Program Workgroup is to coordinate the professional upgrading program within the University of Turku, Åbo Akademi University and the Turku School of Economics and Business Administration. The workgroup is headed by Prof. Joakim von Wright.

### 1.3.5 Advisory Committee

The Advisory Committee is an expert body that consists of representatives from the industrial and economic life of the information technology field, representatives from the public sector, and university representatives. The Advisory Committee arranges four meetings per year and its main task is to increase cooperation between TUCS and its external partners. The Advisory Committee has 25 members and Managing Director Tarmo Hahto acts as the Chairman of the Committee. The members of the Advisory Committee are listed below:

- Hahto Tarmo, Janton Oyj (chairman)
- Hovi Teemu, Tekes (vice chairman)

- Astola Jaakko, Tampere University of Technology, Signal Prosessing
- Broo Roger, Åbo Akademi University
- Eerola Osmo, Telelogic Fnland Oy
- Häyrynen Jouko, Nokia Mobile Phones
- Immonen Juha, Siemens Osakeyhtiö
- Klemets Rabbe, Raisio Group
- Kurki-Suonio Reino, Tampere University of Technology, Software Systems
- Lahesmaa Riitta, Centre of Biotechnology
- Lahoniitty Armas, The City of Turku
- Lehtinen Hannu, Ericsson
- Lindström Folke, Veritas
- Lönnberg Harri, the University of Turku, Organic Chemistry
- Mäntylä Martti, Helsinki University of Technology, Helsinki Institute for Information Technology
- Nieminen Jorma, Benefon Oyj
- Nyberg Kaisa, Nokia Research Center
- Olin Tim, Kuulalaakeri Ltd
- Rasila Matti, The City of Salo
- Ritakallio Ilkka, Teleste Corporation
- Salomaa Arto, TUCS
- Savo Juho, Regional Council of Southwest Finland (Varsinais-Suomen Liitto)

## 1.4 Financing

The activities of TUCS are funded mainly by the Ministry of Education, the Academy of Finland, the municipalities and the three universities of Turku – the University of Turku, Åbo Akademi University and the Turku School of Economics and Business Administration. The

total budget for year 2000 was 13.6 million Finnish marks (including surplus from year 1999) and for 2001 13.5 million marks (including surplus from year 2000).

In 2000, the Centre of Excellence appropriation granted by the Ministry of Education through the three universities was 828,000 Finnish marks. The amount for year 2001 was 414,000 Finnish marks. The Ministry of Education appropriation for the 24 Ph.D. student positions was 3.5 million marks for both 2000 and 2001. The Academy of Finland financed three postdoctoral researcher positions to the amount of 750,000 marks for year 2000. In 2001, the appropriation was 642,400 marks. In addition, the Academy of Finland appropriated TUCS 220,000 Finnish marks in 2000 for the organizing of researcher training courses and for Ph.D. students' travel expenses. In 2001 the appropriation was 165,000 marks.

The municipalities' appropriation was 3.9 million Finnish marks both for year 2000 and 2001. The participating municipalities were Turku, Salo, Raisio, Kaarina, Naantali, Lieto, and Uusikaupunki.

## 1.5 Facilities

TUCS and its Graduate School are situated in DataCity in the Turku Technology Centre, together with a number of other university departments and companies in computer and communication technology, electronics, biotechnology and material sciences.

Most of the participating departments are located in the same building: the Department of Computer Science at the University of Turku on the second floor, the Department of Computer Science at Åbo Akademi University together with the Institute of Information Systems Science at the Turku School of Economics and Business Administration on the third floor, part of the Department for Applied Physics at the University of Turku on the fifth floor, IAMSR at Åbo Akademi University on the sixth floor, and TUCS and its graduate school on the fourth floor. Only the Department of Mathematics at the University of Turku is located elsewhere, on about 10 minutes walking distance. The fact that all researchers and students at TUCS are located so close to each other has turned out to be a great asset, and helps to achieve cooperation and communication between the different units.

## 1.6 TUCS WWW

TUCS provides WWW services (http://www.tucs.fi) on an own server. Information about the daily activities and accumulated results of the research is kept up-to-date on the Web. The web site includes information about the research laboratories, courses and seminars, personnel, publications, open positions and a calendar of events.

On the web site you can find information and statistics about the departments participating in TUCS, the TUCS Graduate School and the TUCS research laboratories. You can easily find contact information to the participating departments as well as to cooperation organizations. There is a description of the organization of TUCS including short presentations of the workgroups, the Advisory Committee, the Graduate School Committee, and the TUCS board. The site is also used as a recruitment channel when recruiting students to the Graduate School and Postdoctoral researchers to the research laboratories.

A bibliographic database, with references to all publications by researchers at TUCS, has been available via the www-server since 1996. It is possible to search the database for publications of

a certain type, from one research group or from a particular researcher. In the end of 2001 the database contained about 2400 references.

## 1.7 International Cooperation

TUCS is a founding member of the European Educational Forum (EEF), a joint initiative of European inter-universitary research schools in computer science. Since the beginning in 1997, EEF has grown from originally three research organizations (BRICS, IPA and TUCS) to six research schools involving 32 universities in Denmark, Finland, Germany, Italy, the Netherlands and the United Kingdom. The aim of the EEF is to organize training activities directed at Ph.D. students and young researchers from all over Europe. The research promoted by all research schools concerns basic research in Computer Science and its applications. EEF is funded by the European Union.

EEF has so far organized 13 summer schools in computer science, of which three have been organized by TUCS. In August 2001, the EEF Summer School on Software Architecture was arranged in Turku. The summer school gathered about 120 participants of which 30 were representatives from the industry. In conjunction with the summer school, a two day workshop entitled "Pattern Mastery through Pattern Writing" was arranged.

Other scientific conferences and workshops were also organized by TUCS in 2000 and 2001. In September 2001, the Turku School of Economics and Business Administration arranged the workshop "t-World2001" in conjunction with the conference "The Eighth International Assembly on Telework", held in Helsinki. The workshop gathered over 200 participants.

TUCS has also been active abroad in cooperating with other countries in Ph.D. education. TUCS director Ralph-Johan Back is a member of the steering committee for PCC, a large research and graduate school project in Sweden in the area of personal computing and tele-communication. Ralph-Johan Back also participates as a supervisor in Nokias Leading Science programme. The goal of the programme is to educate researchers in Nokia NMP.

## 1.8 The Years 2000-2001

This section gives a short overview of the more important changes and events at TUCS during the years 2000-2001.

### 1.8.1 Electronics and Telecommunication

In March 2000, the program in Electronics and Telecommunications technology at the University of Turku joined TUCS. The program belongs to the Department of Applied Physics. Electronics and Telecommunication is actively involved in the education program in Computer Science and Engineering, which is carried out in cooperation between Åbo Akademi University and the University of Turku. Electronics and Telecommunications was also accepted as a new research area within TUCS.

### 1.8.2 Expanded Education in Computer Science and Electronics

In 1998, the Finnish Ministry of Education decided to start a national program in order to expand the education in Computer Science and Engineering and Electronics. Altogether 1000 new students within this area will be admitted annually to the Finnish universities as a result of the program. Of this increase, the universities participating in TUCS will get 120 new student positions annually. The annual student intake to Computer Science and related areas within the three universities has thus increased from 180 in 1997 to over 300 in the year 2000. The total budget for the expansion at the three universities participating in TUCS is about 27 million Finnish marks per year.

According to the expansion plans, the three universities have broadened their cooperation within TUCS to also cover basic education. The M.Sc. program offering degrees in Computer Science, Computer Engineering and Information Systems at the three universities are coordinated with each other. The first part of the studies (up to B.Sc. level) is mainly taught in the language of instruction of the respective universities. The rest (the advanced level studies), is instructed in English. This makes it also possible to recruit foreign students with a B.Sc. in Computer Science or related fields to the program.

The main part of the expansion is directed to the program in Computer Science and Engineering, leading to a Master's of Science in Technology. The student intake to the programs in Computer Science and Engineering increased from 25 in 1997 to 110 in the year 2000. Both Åbo Akademi University and the University of Turku have an own intake to this program. The degree is granted by Åbo Akademi University.

TUCS assumes the role of the coordinating organ for the education programs among the three universities. This has resulted in a considerable change in the organization of TUCS, since its responsibilities extends also to cover basic education. TUCS has therefore established several new workgroups, which are responsible for coordinating the education in each field. Each workgroup has representatives from different universities. The groups have had meetings on a regular basis and they have played an important role in the development of the education programs.

The Computer Engineering workgroup had its first meeting on March 2nd 2000. The most important tasks that the group has handled have included the following: planning the educational programs, functioning as a discussion forum for representatives from the participating universities and producing information for the students. The group has coordinated the work concerning the International Master of Science (M.Sc.) Technology Education and has also developed new web pages for this program. In addition to this, the group has discussed how to further develop the cooperation with companies.

The Computer Science workgroup had its first meeting on March 7th 2000. The most important task for the group has been the coordinating of the educational program. The group has in particular tried to minimize the overlapping of similar courses. The group has also discussed the difficulties in recruiting new, qualified teaching personnel.

The Information Systems workgroup is responsible for coordinating the education and various activities in the Information Systems field. The group had its first meeting on March 9th 2000. The most important tasks have been the planning of IS courses offered by TUCS and coordinating the work regarding three courses that were jointly organized by the universities. The joint courses attracted students from all three universities. The Information Systems workgroup has also organized activities for the students. In

November 2000 the group organized a seminar, in which about 140 students participated.

### 1.8.3 Planning of New Facilities for TUCS

The planning of the new facilities for the expanded education in Information Technology continued during the years 2000 and 2001. The working group appointed by the rectors of the three universities consisted of Jarkko Koskinen (chairman) and Timo Järvi from the University of Turku, Ralph-Johan Back and Mats Aspnäs (secretary) from Åbo Akademi University and Reima Suomi and Rauno Karkulehto from the Turku School for Economics and Business Administration. Later the group was complemented with Jouni Isoaho from the University of Turku.

The working group started by investigating the needs for more space at the departments participating in TUCS. The group worked out a detailed plan for a new building in which most of the education in Information Technology in Turku would be concentrated. The working group met regularly, and especially during the spring 2001 the group was very active. The final decision about building a new house for the education in Information Technology in Turku had not yet been taken by the three universities by the end of 2001, but much of the planning could be completed.

### 1.8.4 TUCS Advisory Committee

To increase cooperation between TUCS and its external partners, TUCS appointed an Advisory Committee in the fall 2000. The first meeting was held in October 2000. The Advisory Committee is presented in section 1.3.5.

### 1.8.5 TUCS Laboratories

Until the beginning of 2001, the research at TUCS was organized in a number of research groups. As a result of the rapid expansion and the changes in TUCS' role as a centre for research and education, it gradually became evident that the organization of the research needed to be restructured. Some of the research groups were very large and covered several research topics. This made it difficult to describe the research activities and point out the broad field of competence within TUCS. The structure did not encourage cooperation between researchers in the different departments participating in TUCS, and particularly not between researchers at different universities. Likewise, it seemed to be difficult to start up new research directions within the old structure.

To simplify the organization of the research at TUCS, it was in the beginning of 2001 decided to reorganize the research into a number of laboratories. A research laboratory consists of a group of researchers, typically between 10 and 30, within a well focused topic of research. A laboratory may be shared between two or more universities. Doctoral students within the TUCS Graduate School will all belong to a laboratory. The laboratories are also responsible for the advanced level education within their own field of research. Laboratories should try to find external funding for their research projects. TUCS decided also to support the laboratories by reserving 1.5 Mmk for this purpose for the year 2001.

By the end of the year, the following 16 research laboratories were formed:

- Algorithmics Laboratory
- Bioinformatics Laboratory
- Biomathematics Laboratory
- Data Mining and Knowledge Management Laboratory
- Discrete Mathematics for Information Technology Laboratory
- Distributed Systems Design Laboratory
- Embedded Systems Laboratory
- Health and Medical Informatics Institute
- High Performance Computing and Communication Laboratory
- Laboris Information Systems Laboratory
- Learning and Reasoning Laboratory
- Microelectronics Laboratory
- Mobile Commerce Laboratory
- Network Economics Institute
- Software Construction Laboratory
- Telecommunication and Digital Systems Laboratory

### 1.8.6 Software Development Centre

The Software Development Centre, OK, was started as a cooperation between TUCS and the Turku polytechnic in the autumn 2000. Its mission is to bridge the requirements of IT-companies' product development with the applied and scientific know-how of the universities and polytechnics in the area. OK carries out software development projects together with industry, and employs students doing their thesis (both from TUCS and the polytechnic) as project workers. The main competence areas of OK are embedded systems, broadband and computer networks, user interfaces and databases, as well as the quality and methods for practical software production process management.

### 1.8.7 Finnish Computer Science Days

The Finnish Society for Computer Science and TUCS together arranged the National Computer Science days 21 – 22 of May, 2001 in Turku. About 100 teachers and researchers from the Finnish universities participated.

# 2 Research

TUCS researchers come from the areas of Computer Science, Mathematics, Information Systems, and Electronics and Telecommunication. The focus of research is on Information Technology. The main areas of research at TUCS are:

- Algorithmics (A)
- Discrete Mathematics (DM)
- Electronics and Telecommunication (ETC)
- Embedded Systems (ES)
- Information Systems (IS)
- Mathematical Modeling (MM)
- Software Engineering (SE)

The research at TUCS is organized in sixteen research laboratories. The laboratories are independent and choose their own research topics. The research laboratories are organized around one to three professors and in addition to that consist of senior researchers, postdoctoral researchers, Ph.D. students and M.Sc. students. The research groups get external funding from the Academy of Finland (basic research), TEKES (industrial applied research) or directly from the industry. A principle of matching external funding is followed in allocating TUCS funding to the research laboratories, in particular what comes to Ph.D. students and postdoctoral positions. TUCS internal funding thus favors those research laboratories that are successful in competing for external funding. The laboratories provide supervision both for Ph.D. and M.Sc. students, and are also responsible for teaching advanced level courses within their own specific research area.

The research laboratories at TUCS are listed below. More detailed information about the laboratories is provided by the leaders of the groups, and can be found at the TUCS home pages.

## 2.1 Algorithmics Laboratory

**Leader**: Olli Nevalainen and Timo Raita

**Researchers**: Tero Aittokallio, Timo Knuutila, Timo Kaukoranta, Ville Leppänen, Jukka Teuhola

**Graduate students**: Lasse Bergroth, Marius Codrea, Attila Gyenesei, Harri Hakonen, Mika Hirvikorpi, Mika Keränen, Juha Kivijärvi, Markus Kurki, Joonas Lehtinen, Jussi Salmi, Kari Salonen, Jouni Smed

**Research topics**:

- Combinatorial algorithms and applications
- Text, dictionary, and image compression
- String algorithms
- Database structures and search methods for databases
- Industrial algorithms
- Constraint programming
- Parallel machines and algorithms
- Vector quantization
- Analysis of biomedical signals

## 2.2 Bioinformatics Laboratory

**Leader**: Tapio Salakoski
**Researchers**: Jorma Boberg, Jouni Järvinen, Tomi Pasanen
**Graduate students**: Filip Ginter, Eija Nordlund, Pentti Riikonen, Timo Viljanen.
Co-operation with Biotechnology Center, Dept of Biochemistry at ÅA and Institute of Medical Technology, University of Tampere
**Research interests:**

- Analysis of functional genomics and related data
- Development of biological databases and analysis tools
- Mobile bioinformatics: wireless access to biological databases and bioinformatics services

## 2.3 Biomathematics Laboratory

**Leader**: Mats Gyllenberg
**Researchers**: Timo Leipälä, Heikki Ruskeepää, Stefan Geritz, Eva Kisdi, Marjo Lipponen, Tero Aittokallio, Kalle Parvinen
**Graduate students**: Jarmo Hemminki, Diana Ion, Jorma Jaakkola, Nelly Noikova, Ville-Veikko Rantanen, Ping Yan
**Research topics**:

- Mathematical theory of population dynamics (especially structured populations and metapopulations) with applications to ecology with special attention to conservation biology
- Adaptive dynamics, i.e., the interaction between population dynamics, evolutionary dynamics and the physical environment
- Mathematical foundations of taxonomy and the development of classification algorithms
- Modeling and analysis of physiological phenomena with applications to treatment of heart rate variability and sleep apnea

## 2.4 Data Mining and Knowledge Management Laboratory

**Leaders**: Professor Barbro Back
**Members:** Professors Inger Eriksson, Eija Karsten and Kaisa Sere
**Graduate students**: Adrian Costea, Tomas Eklund, Erkki Innola, Minna Kallio, Jonas Karlsson, Antonina Kloptchenko, Eija Koskivaara, Dorina Marghescu, Adekunle Okunoye
**Research interests**:

- Developing, implementing and evaluating new methods for data mining and knowledge management.
- Practical implementation studies in organizations.

## 2.5 Discrete Mathematics for Information Technology Laboratory

**Leader**: Juhani Karhumäki
**Researchers**: Arto Salomaa, Magnus Steinby, Jarkko Kari, Jyrki Lahtonen, Iiro Honkala, Tero Harju, Juha Honkala, Ari Renvall, Eija Jurvanen, Tero Laihonen, Jouni Järvinen, Tatjana Petkovic
**Graduate students**: Arto Lepistö, Mika Hirvensalo, Vesa Halava, Ion Petre, Jan Manuch, Tommi Meskanen, Matti Rönkä, Paula Steinby, Saeed Salehi, Dirk Nowotka, Gordon Alford, Kalle Ranto, Sanna Ranto, Petri Rosendahl, Jarkko Hiltunen
**Research interests**:

- Decidability questions
- Automata theory and term rewriting
- Combinatoric on words
- Cellular automata with applications
- Cryptography, in particular protocols and applications to industry
- Coding theory with applications
- Graph theory
- Quantum computing

## 2.6 Distributed Systems Design Laboratory

**Leader**: Kaisa Sere
**Researchers**: Juha Plosila, Elena Troubitsyna, Marina Waldén, Tiberiu Seceleanu
**Graduate students**: Pasi Liljeberg, Luigia Petre, Rimvydas Ruksenas, Tomi Westerlund
**Research interests**:

- Design methodology for distributed systems
- Component-based design approaches
- Distributed systems with mobile components
- Design and analysis of hybrid systems
- Design methodology for asynchronous and synchronous as well as mixed asynchronous /synchronous circuits
- Methodology for SoC design
- Integration of informal or semi formal notations and methods like UML and VHDL with formal notations within different phases of system design
- Coordination paradigm in the overall software architecture and its use in formal systems engineering
- Safety analysis techniques and their role as an integral part of formal systems engineering
- Asynchronous communication paradigm for components in general and for embedded systems in particular

## 2.7 Embedded Systems Laboratory

**Leader**: Johan Lilius
**Researchers**: Risto Lahdelma
**Graduate students**: Dag Björklund, Antero Järvi, Juha Kivijärvi, Sébastien Lafond, Jonas Munsin, Dragos Truscan, Seppo Virtanen
**Research interests**:

- Methods for co-design of systems with heterogeneous models of computation
- Object-oriented methods for designing embedded systems
- Java for embedded systems
- Networked embedded devices

## 2.8 Health and Medical Informatics Laboratory

**Leader**: Timo Järvi
**Researchers**: Eija Karsten, Olli Nevalainen, Markku Nurminen, Reima Suomi
**Graduate students**: Thomas Hughes, Jarmo Tähkäpää
**Research interests**:

- Computer assisted medical diagnosis
- Recognition, analysis and compression of imaging or signal data
- Computer-assisted diagnosis of medical images
- Data mining in medical data
- Evaluation of health information systems
- Organizational implementation of health information systems
- IT support for the care chain
- IT in evolving work practices in health care
- Mobile IT in home care
- IT in working life health care
- Usability of health care information systems
- Evaluation of health care information systems
- Providing service and activities through internet and e-commerce
- Strategic information systems planning and assessment for health care organizations

## 2.9 High Performance Computing and Communication Laboratory

**Leader**: Jan Westerholm
**Researchers**: Mats Aspnäs, Qiong Chen, Xinrong Zhou
**Research interests**:

- Parallel computing clusters, cluster performance
- Computer graphics: algorithms, hardware performance
- Small footprint communication: Bluetooth performance

## 2.10 LABORIS Information Systems Laboratory

**Leader**: Markku Nurminen
**Researchers**: Inger Eriksson, Eija Karsten, Satu Aaltonen, Pekka Reijonen
**Graduate students**: Antti Tuomisto, Sanna Numerla-Toivonen, Kai Kimppa, Adekunle Okunoye, Mikko Savela
**Research interests**:

- Improving the usability of Information Systems (IS) in organizational business context
- Developing methodologies for evaluating the usability of information systems

## 2.11 Learning and Reasoning Laboratory

**Leader**: Joakim von Wright
**Researchers**: Tapio Salakoski, Jorma Boberg, Linas Laibinis
**Graduate students**: Orieta Celiku, Åke Gustavson, Li Chang, Lu Yan
**Research interests**:

- Research in Computer Science Education, Educational Technology and Distance Education
- Development of a virtual undergraduate Computer Science curriculum
- Development of learning environments for use in education, industry and business
- Methodological and technological support for course development within TUCS, for selected courses especially in new field
- Research in mechanized reasoning and programming logic

## 2.12 Microelectronics Laboratory

**Leader**: Risto Punkkinen
**Researchers**: Tom Kuusela, Juhani Peltonen, Hannu Tenhunen, Esa Tjukanoff
**Graduate students**: Hannu-Pekka Hedman, Lauri Heikkilä
**Research interests:**

- Light emitting (electroluminescence) silicon/silicon dioxide structures fabricated by using normal IC-technology
- Manufacturing technology
- Physical architecture of interconnects and integrated circuits
- Sensor technology
- System on package design
- Research interests:

## 2.13 Mobile Commerce Laboratory

**Leader**: Pirkko Walden
**Researchers**: Christer Carlsson, Shuhua Liu
**Graduate students**: Bill Anckar, Chihab Benmoussa, Ulrika Gustafsson, Shenghan Han, Ville Harkke, Pär Landor, Anas Lanedri, Ruggero Rossi de Mio, Anna Sell (Törnroos)
**Research interests**:

- Mobile e-commerce

- Theory-oriented research in user interfaces
- Software Agent technology and support systems
- Applied research, which is focused on planning and problem solving with corporate partners

## 2.14 Network Economics Laboratory

**Leader**: Hannu Salmela
**Researchers**: Reima Suomi, Jussi Puhakainen, Markus Granlund, Timo Leino
**Graduate students**: Timo Lainema, Jonna Järveläinen, Victor Tsygankov, Johanna Holm, Lauri Salmivalli, Olli Järvinen, Juha Kontio, Jarmo Tähkäpää, Irina Nori, Timo Kestilä, Elina Syrjänen, Mikko Ääri, Jussi Nissilä
**Research interests**:

- Strategic planning of information systems
- Network Economics
- Management if Information Resources

## 2.15 Software Construction Laboratory

**Leader**: Ralph-Johan Back
**Researchers**:
**Graduate students**: Cristina Cerschi, Joakim Isaksson, Luka Milovanov, Luigia Petre, Ivan Porres, Viorel Preoteasa, Marcus Alanen
**Research interests**:

- Techniques and methods for software construction
- Software analysis and design methods, programming methods, languages and environments, and the software construction process at large
- Construction of highly reliable and functionally correct software systems
- The use of UML in software analysis and design
- Software construction environments
- Object-oriented programming (methods, theory, semantics, correctness)
- Programming logics (program correctness, semantics, program refinement)

## 2.16 Telecommunication and Digital Systems Laboratory

**Leader**: Jouni Isoaho
**Researchers**: Valery Ipatov, Hannu Tenhunen, Juha Plosila, Afshin David, Tiberiu Seceleanu, Ari Paasio, Juhani Peltonen
**Graduate students**: Tommi Laine, Tuomas Valtonen, Seppo Virtanen, Tomi Westerlund, Tero Nurmi, Pasi Liljeberg, Jarkko Paavola, Sami Nuutila
**Research interests**:

- Dynamic/distributed cognitive communication concepts
- Reconfigurable telecommunication system platforms and design methodologies for multimedia communications and ubiquitous electronics
- Cognitive radio
- Dynamic communication and computation
- Reconfigurable architectures and system platforms

- On-chip communication
- IP based SoC design methodology
- Physical performance modeling

# 3 TUCS Graduate School

The Graduate School of Turku Centre for Computer Science (TUCS) offers a program for gaining the Doctoral (Ph.D.) degree in Computer Science, Mathematics, Information Systems, Computer Engineering, Communication Systems, and Microelectronics. It is open for students from everywhere. The language of instruction is English. Prerequisites are either a Master's or a Bachelor's degree in a relevant field. Study time is expected to be 4 years.

The Graduate School offers advanced level courses within the field of Information Technology and supervision of students within existing research laboratories. Students are expected to take courses from at least two of the research areas represented at TUCS. Each student is assigned a supervisor from one of the research laboratories.

## 3.1 Curriculum Requirements

The curriculum for the Master's degrees and the Doctor's degrees follow the Finnish standard requirements. The Ph.D. degree normally requires a Master's degree. The Master's degree requires 40 credits in addition to the B.Sc. exam. A part of these credits are obtained by taking courses and part by writing a Master's thesis. After completing the M.Sc. degree, the student must take an additional 40 credits courses and carry out research leading up to a Ph.D. thesis. A standard course, covering approximately 50 hours of lectures, 20 hours of assignments in class and a smaller project assignment will usually give 5 credits. There are also smaller courses and seminars, giving 1-3 credits.

## 3.2 Academic Year

The academic year begins on the 1st of August and ends on the 31st of July. Lectures are given from the beginning of September to the end of May. Course examinations are usually concentrated to the end of the terms.

## 3.3 Financing the Studies

The TUCS Graduate School offers a number of grants for students from abroad. The grant is sufficient to cover housing and basic living expenses. Doctoral students from Finland or the European Union are paid a salary, which after taxes is equivalent to the grant. The maximum time for funding is four years. The funding is given for about one year at a time: every year the students are expected to submit a Study Report, which measures their study progress during the past year. Their supervisors also give a statement about their studies. The funding is thus conditional and based on the progress that has been made. There are no tuition fees for the Graduate School.

## 3.4 Application Procedure

The Graduate School receives applications on a continuous basis. They are examined twice a year by the Graduate School Committee, on whose recommendations the TUCS Board makes

the decision on how many of the applicants can be financed by the Graduate School or accepted to the Graduate School without funding. The formal decisions about admittance for PhD studies are made by the Faculties.

Prerequisites for the Graduate School are a Master's or a Bachelor's degree in Information Technology, Economic Sciences (majoring in a field related to Information Technology), Business Administration (majoring in a field related to Information Technology) or in a closely related field. A certificate of knowledge of English is required for applicants outside Finland.

There are no specific application forms. Applicants address a formal application letter to the Director of TUCS and enclose the following documents:

1. Curriculum vitae;
2. Financing plan for studies and / or application for financial support, if requested;
3. Short description of research interests;
4. Officially certified copy of degree certificate with official English translation (or Finnish/Swedish);
5. Certified copy of academic transcript with official English translation (or Finnish/ Swedish)
6. Two letters of recommendation in English with referees' full contact addresses (shall be sent to the TUCS by the referees)
7. Certificate of knowledge of English:
    - the TOEFL (Test of English as a Foreign Language) (minimum 550 points (paper based) or 213 (computer based); or
    - the IELTS test (International English Language Testing System) with an overall band score of 6.5 and no individual score below 5.5;
    - or corresponding knowledge in English.

In 2000 and 2001, the deadlines for applications were May 15th for studies starting in September, and October 31st for studies starting in January.

## 3.5 New students 2000-2001

The following 13 new Ph.D. students began their studies at the TUCS Graduate School in 2000:

- *Davide D'Incau*, MBA, University of Trento, Italy.
- *Dragis Truscan*, M.Sc. in Computer Science, University of Bucharest, Romania.
- *Victor Tsygankov*, Diploma in Information Business, Moscow State University of Economics, Statistics and Informatics, Russia.
- *Mantao Xu*, M.Sc. in Mathematics, HIT, Harbin, China.
- *Adrian Costea*, B.Sc., Turku School Economics and Business Administration, Finland.
- *Marius Codrea*, Academy of Economic Studies, Bucharest, Romania.
- *Urpo Kaila*, B.Sc., Svenska Handelshögskolan, Helsingfors (part-time Ph.D student), Finland
- *Antonina Kloptchenko*, M.Eng., Taganrog State University, Russia.
- *Sébastien Lafond*, M.Sc. in Computer Science, Engineer School, Rouen, France.
- *Anas Lanedri*, MBA, Al Akhawayn University, Morocco.
- *Yan Lu*, B.Sc. in Computer Science, Peking University, China.
- *Petri Rosendahl*, M.Sc., University of Turku, Finland
- *Saeed P. Salehi*, B.Sc. in Mathematics, Sharif University of Technology, Tehran, Iran.

The following 15 new Ph.D. students began their studies at the TUCS Graduate School in 2001:

- *Dag Björklund*, M.Sc. eng., Åbo Akademi University, Finland
- *Irina Georgescu*, Economist, Academy of Economic Studies, Bucharest, Romania
- *Chang Li*, M.Sc. in Computer Science, University of Birmingham, England, MA in Logic Science, China Norm. Southwest University, China
- *Jonas Munsin*, M.Sc. eng., Åbo Akademi University, Finland
- *Tuomas Valtonen*, M.Sc. in Computer Science and Engineering, Teknillinen korkeakoulu, Helsinki, Finland
- *Chihab Benmoussa*, MBA, Al Akhawayn University, Morocco
- *Filip Ginter*, M.Sc., Technical University of Ostrava, Czech Republic
- *Shengnan Han*, M.Econ, Renmin University, P.R. China
- *Ville Harkke*, M.Econ, Åbo Akademi University, Finland
- *Johanna Holm*, MBA, Turku School of Economics and Business Administration, Finland
- *Tommi Laine*, M.Sc. in Physics, the University of Turku, Finland
- *Peter Majlender*, M.Sc. in Applied Mathematics, Eotvos University, Hungary
- *Ruggiero Rossi de Mio*, M.Econ, University of Trento, Italy
- *Tuure Välimaa*, M.Sc. in Mathematics, the University of Tampere, Finland
- *Tomi Westerlund*, M.Sc. in Electronics, the University of Turku, Finland

# 4 Personnel

In the following section, the personnel of the departments participating in TUCS, is presented. In addition to the personnel at the departments, TUCS also has its own administrative staff (presented in the end of this section).

## 4.1 Faculty

The faculty of TUCS consists of professors, lecturers and assistant professors working at the departments participating in TUCS. The present faculty is listed below, with their affiliation, e-mail address and research interests.

Harri Arvela, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: harri.arvela@utu.fi. Research interests: digital signal processing, thin film and sensor technology.

Mats Aspnäs, Acting Professor at Åbo Akademi University, Department of Computer Science. E-mail: mats@abo.fi. Research interests: parallel programming, programming tools and environments for parallel systems, applications of parallel programming.

Barbro Back, Professor at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: bback@abo.fi. Research interests: accounting information systems, neural networks, genetic algorithms, electronic commerce.

Ralph-Johan Back, Professor at Åbo Akademi University, Department of Computer Science. E-mail: backrj@abo.fi. Research interests: programming methodology, formal methods, parallel and distributed programming

Jorma Boberg, Lecturer at the University of Turku, Computer Science. E-mail: Research interests: bioinformatics, clustering algorithms and analysis, classification and prediction of protein structures.

Christer Carlsson, Professor at Åbo Akademi University, the Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: ccarlsso@abo.fi. Research interests: knowledge-based systems, fuzzy logic and multi criteria decision making.

Afshin David, Assistant professor at the University of Turku, Electronics and Information Technology. E-mail: afshin.david@utu.fi. Research interests: DSP algorithms.

Inger Eriksson, Professor at the University of Turku, Computer Science. E-mail: Research interests: information systems.

Mats Gyllenberg, Professor at the University of Turku, Department of Mathematics. E-mail: mats.gyllenberg@utu.fi. Research interests: dynamical systems, classification of binary vectors; applications to population dynamics, ecology and taxonomy.

Jouni Isoaho, Professor at the University of Turku, Electronics and Information Technology. E-mail: jouni.isoaho@utu.fi. Research interests: future communication and computing methods and platforms, system design methodologies for nano-scale systems, dynamic reconfigurable systems, SoC communication platforms, and physical performance modelling and noise analysis.

Timo Järvi, Professor at the University of Turku, Computer Science. E-mail: jarvi@it.utu.fi. Research interests: Medical informatics, data bases, computer architecture.

Jouni Järvinen, Lecturer at the University of Turku, Computer Science. E-mail: Research interests: mathematic logic, bioinformatics.

Juhani Karhumäki, Professor at the University of Turku, Department of Mathematics. E-mail: karhumak@cs.utu.fi. Research interests: formal languages, automata, cryptography, combinatorics of words.

Eija Karsten, Professor at the University of Turku, Computer Science. E-mail: eija.karsten@cs.utu.fi. Research interests: information systems, IT and work.

Timo Knuutila, Professor at the University of Turku, Computer Science. E-mail: timo.knuutila@it.utu.fi. Research interests: logic programming, automata, machine learning.

Risto Lahdelma, Professor at the University of Turku, Computer Science. E-mail: risto.lahdelma@it.utu.fi. Research interests: embedded optimization systems, large-scale software engineering tools, decision support.

Jyrki Lahtonen, Assistant Professor at the University of Turku, Mathematics. E-mail: lahtonen@utu.fi. Research interests: coding theory.

Ville Leppänen, Assistant Professor at the University of Turku, Computer Science. E-mail: ville.leppanen@it.utu.fi. Research interests: parallelism, routing and embedding problems, object-oriented programming languages.

Johan Lilius, Professor at Åbo Akademi University, Department of Computer Science. E-mail: johan.lilius@abo.fi. Research interests: model checking, hardware/software co-design, theory of distributed systems: Petri nets, foundations of concurrent object oriented programming, formal methods: the world wide web virtual library: formal methods.

Paul Lindholm, Lecturer at Åbo Akademi University, Department of Computer Science. E-mail: paul.lindholm@abo.fi.

Olli Nevalainen, Professor at the University of Turku, Computer Science. E-mail: olli.nevalainen@it.utu.fi. Research interests: algorithmics.

Markku Nurminen, Professor at the University of Turku, Computer Science. E-mail: markku.nurminen@it.utu.fi. Research interests: information systems.

Tomi Pasanen, Lecturer at the University of Turku, Computer Science. E-mail: Research interests: algorithmics, bioinformatics.

Juhani Peltonen, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: juhani.peltonen@utu.fi. Research interests: Processor systems, neural networks.

Aulis Pirinen, Acting Professor at Åbo Akademi University, Department of Computer Science. E-mail: aulis.pirinen@abo.fi. Research interests: telecommunication, telecommunications software, protocol design, network optimization, broadband communication and its transmission technology (ATM), teletraffic and traffic theory.

Juha Plosila, Assistant professor at University of Turku, Electronics and Information Technology. E-mail: juha.plosila@utu.fi. Research interests: ULSI design and formal methods.

Risto Punkkinen, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: risto.punkkinen@utu.fi. Research interests: semiconductor technology, particle/radiation detectors.

Timo Raita, Professor at the University of Turku, Computer Science. E-mail: raita@cs.utu.fi. Research interests: data compression methods.

Ari Renvall, Assistant at the University of Turku, Mathematics. E-mail: ariren@utu.fi. Research interests: cryptography.

Tapio Reponen, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science (on leave for rectorship). E-mail: tapio.reponen@tukkk.fi. Research interests: information systems strategies, management of IS function.

Tapio Salakoski, Professor at the University of Turku, Computer Science. E-mail: tapio.salakoski@it.utu.fi. Research interests: bioinformatics, computer science education, object oriented programming.

Hannu Salmela, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: hannu.salmela@tukkk.fi. Research interests: strategic planning of information systems, investments in information systems, managements of IT-projects.

Jussi Salmi, Lecturer at the University of Turku, Computer Science. E-mail: Research interests: algorithmics, medical data analysis, artificial intelligence, neural networks.

Arto Salomaa, Professor emeritus at the University of Turku, Department of Mathematics, Academy Professor, Academy of Finland. E-mail: asalomaa@utu.fi. Research interests: formal languages, automata, cryptography.

Tiberiu Seceleanu, Assistant professor at the University of Turku, Electronics and Information Technology. E-mail: tiberiu.seceleanu@utu.fi. Research interests: Formal methods and SoC design.

Kaisa Sere, Professor in Computer Science and Engineering at Åbo Akademi University, Department of Computer Science. E-mail: kaisa.sere@abo.fi. Research interests: formal methods, parallel and distributed systems.

Annamari Soini, Lecturer at Åbo Akademi University, Department of Computer Science. E-mail: annamari.soini@abo.fi.

Ulla Solin, Lecturer at Åbo Akademi University, Department of Computer Science. E-mail: ulla@abo.fi. Research interests: parallel programming, real time systems.

Magnus Steinby, Professor at the University of Turku, Department of Mathematics. E-mail: steinby@utu.fi. Research interests: mathematical logic, tree automata.

Reima Suomi, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: reima.suomi@tukkk.fi. Research interests: inter-organizational information systems, telecommunications management.

Jukka Teuhola, Lecturer at the University of Turku, Computer Science. E-mail: jukka.teuhola@it.utu.fi. Research interests: databases, algorithmics.

Aimo Tietäväinen, Professor at the University of Turku, Department of Mathematics. E-mail: tietavai@cs.utu.fi. Research interests: coding theory.

Esa Tjukanoff, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: esa.tjukanoff@utu.fi. Research interests: SoP technology and modelling.

Elena Troubitsyna, Assistant professor at Åbo Akademi University, Department of Computer Science. E-mail: etroubit@abo.fi. Research interests: formal methods for design of dependable systems.

Antti Tuomisto, Lecturer at the University of Turku, Computer Science. E-mail: Research interests: information systems.

Aimo Törn, Professor at Åbo Akademi University, Department of Computer Science. E-mail: atorn@abo.fi. Research interests: simulation methodology, global optimization, software quality.

Harry Virtanen, överassistent at Åbo Akademi University, Department of Computer Science. E-mail: harry.virtanen@abo.fi.

Marina Waldén, Assistant professor at Åbo Akademi University, Department of Computer Science. E-mail: mwalden@abo.fi. Research interests: formal construction and analysis of distributed systems.

Pirkko Walden, Acting professor at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: pwalden@abo.fi. Research interests: strategic management, knowledge-based systems, electronic commerce.

Ragnar Wikman, Lecturer at Åbo Akademi University, Department of Computer Science. E-mail: ragnar.wikman@abo.fi.

Joakim von Wright, Professor at Åbo Akademi University, Department of Computer Science. E-mail: jwright@abo.fi. Research interests: programming methodology, mechanical verification.

## 4.2 Adjunct Faculty

The adjunct faculty of TUCS consists of researchers who are actively involved in the research and teaching at TUCS but which do not directly belong to any of the research groups of TUCS.

Jarmo Alander, Professor in Production Automation at the University of Vaasa, Department of Information Technology and Industrial Management, E-mail: jarmo.alander@uwasa.Fi. Research interests: automation, genetic algorithms, electronics, robotics, etc, medical imaging, ancient documents (papyri, cuneiform scripts).

Malin Brännback, Research Director, D.Sc (Econ. & Bus.Adm.), B.Sc (Pharm.) at Turku School of Economics and Business Administration/Innomarket Unit. E-mail: malin.brannback@tukkk.fi. Research interests: pharmaceutical industry, pharmacy practice, medical informatics, internet-based information systems, electronic commerce, strategic market management, knowledge-based management, relationship marketing.

Patrik Eklund, Professor at Umeå University, Department of Computing Science, Sweden. E-mail: peklund@cs.umu.se. Research interests: fuzzy systems, information system application, neural networks.

Robert Fullér, Professor at Eötvös Loránd University, Department of Computer Science, Budapest, Hungary. E-mail: rfuller@abo.fi. Research interests: approximate reasoning, soft decision analysis, neural fuzzy systems for decision support, computational intelligence in finance.

Matti Jakobsson, Professor in Information Technology at the University of Vaasa, Department of Information Technology and Production Economics, Faculty of Industrial Management. E-mail: mj@uwasa.fi. Research interests: information management and strategy, user interaction, multimedia.

Martti Juhola, Professor at University of Tampere. E-mail: martti.juhola@uta.fi. Research interests: pattern recognition, medical applications of computing.

Jyrki Katajainen, Docent at the University of Turku, Computer Science, Professor at the University of Copenhagen. E-mail: jyrki@diku.dk. Research interests: algorithmics.

Timo Koski, Professor at the University of Turku, Department of Applied Mathematics. E-mail: tkoski@utu.fi. Research interests: classification algorithms, probability.

Matti Linna, Professor in Information Technology at University of Vaasa, Department of Information Technology and Production Economics. E-mail: mj@uwasa.fi. Research interests: automata theory and formal languages, heterogenous distributed databases and multimedia.

Valtteri Niemi, Professor at University of Vaasa. E-mail: valtteri.niemi@research.nokia.com. Research interests: cryptography, formal languages.

Martti Penttonen, Professor at University of Kuopio. E-mail: martti.penttonen@uku.fi. Research interests: parallel computing, structured documents, logic programming, theoretical computer science.

## 4.3 Researchers

The following researchers are actively involved in TUCS and the Graduate School, as members of research teams and as supervisors of M. Sc. and Ph. D. studies.

Luis Alvarez, Researcher at the University of Turku, Mathematics. E-mail: alvarez@utu.fi. Research interests: diffusion processes, stochastic calculus, mathematical economics, mathematical bioeconomics.

Pasi Fränti, Researcher at the University of Joensuu, Department of Computer Science. E-mail: franti@cs.joensuu.fi. Research interests: image processing and compression.

Stefan Geritz, Researcher at the University of Turku, Mathematics. E-mail: sgeritz@utu.fi. Research interests: adaptive dynamics, speciation, evolution of migration in metapopulation.

Marko Grönroos, Researcher at Åbo Akademi University, Department of Computer Science. E-mail: magi@utu.fi.

Tero Harju, Researcher at the University of Turku, Department of Mathematics. E-mail: harju@utu.fi. Research interests: automata theory, combinatorics of words, graph theory.

Jukka Heikkilä, Researcher at the University of Turku, Computer Science. E-mail: heikkila@cs.utu.fi. Research interests: information systems.

Jarmo Hemminki, Assistant at the University of Turku, Mathematics. E-mail: jhemmin@utu.fi. Research interests: structured population models.

Iiro Honkala, Assistant professor at the University of Turku, Mathematics. E-mail: honkala@cs.utu.fi. Research interests: coding theory.

Juha Honkala, Researcher at the University of Turku, Mathematics. E-mail: jhonkala@utu.fi. Research interests: L systems, formal power series, number systems.

Eija Jurvanen, Ph.D, researcher at the University of Turku, Mathematics. E-mail: jurvanen@utu.fi. Research interests: tree automata.

Jaakko Järvi, Researcher at the University of Turku, Computer Science. E-mail: jaakko.jarvi@cs.utu.fi. Research interests: biomedical signal analysis, object oriented numerics.

Kalle Kangas, Assistant professor at the Turku School of Economics and Business Admistration. E-mail: kalle.kangas@tukkk.fi.

Timo Kaukoranta, Researcher at the University of Turku, Computer Science. E-mail: tkaukora@cs.utu.fi. Research interests: image compression (block truncation coding, vector quantization, image quality) and image processing.

Eva Kisdi, Researcher at the University of Turku, Mathematics. E-mail: evakis@utu.fi. Research interests: evolutionary ecological models concerning adaptive dynamics and life history evolution.

Tom Kuusela, Researcher at the University of Turku, Electronics and Information Technology. E-mail: kuusela@utu.fi. Research interests: solitons, solitary waves, toda lattice, non-linear electrical transmission lines, chaotic electrical systems, modelling cardiovascular system.

Linas Laibinis, Researcher at Åbo Akademi University, Department of Computer Science. E-mail: llaibini@abo.fi. Research interests: mechanisation of the refinement calculus, interactive environments for proof and/or program construction.

Shuhua Liu, Researcher at Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: sliu@abo.fi.

Sami Nuuttila, M.Sc., assistant at the University of Turku, Electronics and Information Technology. E-mail: sami.nuuttila@utu.fi.

Jarkko Paavola, M.Sc., assistant at the University of Turku, Electronics and Information Technology. E-mail: jarkko.paavola@utu.fi.

Jonne Poikonen, M.Sc., assistant at the University of Turku, Electronics and Information Technology. E-mail: jonne.poikonen@utu.fi.

Pekka Reijonen, Researcher at the University of Turku, Computer Science. E-mail: pekka.reijonen@cs.utu.fi.

Pentti Riikonen, Researcher at the University of Turku, Computer Science. E-mail: pentti.riikonen@cs.utu.fi. Research interests: information systems.

Reino Vainio, Docent at Åbo Akademi University, Department of Mathematics. E-mail: reino.vainio@abo.fi. Research interests: connectivity concepts, order completions, ordered function.

## 4.4 Visiting Researchers and Postdoctoral Researchers

The following researchers have been active at TUCS either as long term visiting researchers or employed as postdoctoral researchers during 2000-2001.

C. Chorrfut, Paris, France. Researcher at the University of Turku, Mathematics.

Xiaocong Fan, Postdoctoral researcher at Åbo Akademi University, Department of Computer Science. E-mail: fan.xc@abo.fi.

F. Gecseg. Researcher at the University of Turku, Department of Mathematics.

J. Hromkovivc, Aachen, Germany. Researcher at the University of Turku, Department of Mathematics.

Oscar H. Ibarra, researcher at the University of Turku, Department of Mathematics. Professor at the Department of Computer Science, University of California, USA.

Valery Ipatov, Visiting professor at the University of Turku, Electronics and Information Technology. E-mail: valery.ipatov@utu.fi. Research interests: spread spectrum radio systems.

Mika Johnsson, Postdoctoral researcher at the University of Turku, Computer Science. E-mail: johnsson@cs.utu.fi. Research interests: combinatorial optimisation, TSP, production planning in electronic industry, scheduling algorithms, machine optimisation.

Tero Laihonen, Postdoctoral researcher at the University of Turku, Mathematics. E-mail: terolai@utu.fi. Research interests: coding theory.

L. Lisovik, researcher at the University of Turku, Mathematics. Professor at the State University of Ukraine.

S. Marcus, Bucharest, Romania. Researcher at the University of Turku, Mathematics.

Ari Paasio, Postdoctoral researcher at the University of Turku, Electronics and Information Technology. E-mail: ari.paasio@utu.fi. Research interests: cellular neural/nonlinear networks.

Tatjana Petkovic, Postdoctoral researcher at the University of Turku, Mathematics. E-mail: tatjana@cs.utu.fi. Research interests: Automata Theory, Algebraic Theory of Semigroups, Formal Languages, Theory of Rings.

Alfonso Rodriguez-Paton, Postdoctoral researcher at the University of Turku, Mathematics.

Hannu Tenhunen, Visiting professor at the University of Turku, Electronics and Information Technology. E-mail: hannu@imit.kth.se. Research interests: ULSI design.

Haiyi Zhang, Postdoctoral researcher at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR).

Xinrong Zhou, TUCS Postdoctoral researcher at Åbo Akademi University, Department of Computer Science. E-mail: xrzhou@abo.fi. Research interests: Computer Architecture, Parallel I/O, Cluster Computing, Operating System, Ad Hoc Networks

## 4.5 Ph.D. Students

The following students have been enrolled for studies with TUCS Graduate School during the years 2000 and 2001:

Tero Aittokallio, M.Sc., the University of Turku, Mathematics. E-mail: tero.aittokallio@utu.fi. Research interests: analysis of biomedical signals, pattern recognition.

Francisco Alcaraz Carcia, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: falcaraz@abo.fi. Research interests: analysis of biomedical signals, pattern recognition.

Gordon Alford, M.Sc., the University of Turku, Mathematics. E-mail: gordon@cs.utu.fi. Research interests: formal language theory, specifically DNA computing.

Bill Anckar, Ph.D. Student at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: banckar@abo.fi.

Chihab BenMoussa, MBA, Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: cbenmous@abo.fi.

Orieta Celiku, B.A., Åbo Akademi University, Department of Computer Science. E-mail: orieta.celiku@abo.fi.

Cristina Cerschi, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: ccerschi@abo.fi. Research interests: formal modeling and verification, software reliability, hybrid/control systems, controller synthesis, functional programming, computer algebra tools, GUI design

Marius-Cosmin Codrea, B.Sc., the University of Turku, Computer Science. E-mail: codrea@cs.utu.fi.

Adrian Costea, B.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: acostea@abo.fi.

Irina Georgescu, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: igeorges@abo.fi.

Mehran Gomari, Researcher at the University of Turku, Computer Science. E-mail: gomari@cs.utu.fi. Research interests: applying artificial neural networks for solving medical problems.

Åke Gustavsson, Lecturer at Åbo Akademi University, Department of Computer Science. E-mail: agustavs@abo.fi. Research interests: petri nets, hardware/software co-design, simulation, graphs, AI, programming interface.

Attila Gyenesei, M.Sc., the University of Turku, Computer Science. E-mail: gyenesei@cs.utu.fi.

Harri Hakonen, M.Sc., the University of Turku, Computer Science. E-mail: hat@cs.utu.fi. Research interests: string algorithms, software construction.

Vesa Halava, M.Sc., the University of Turku, Mathematics. E-mail: vehalava@utu.fi. Research interests: automata and formal languages, computability, combinatorics on words.

Shengnan Han, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: shan@abo.fi.

Ville Harkke, M.Sc.(Econ.), Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: vharkke@abo.fi.

Jeanette Heidenberg, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: jeanette@infa.abo.fi. Research interests: mechanical verification.

Jarkko Hiltunen, M.Sc., the University of Turku, Mathematics. E-mail: jakahi@utu.fi. Research interests: coding theory.

Mika Hirvensalo, Ph.Lic., the University of Turku, Mathematics. E-mail: mikhirve@utu.fi. Research interests: quantum computing.

Samuel Holmström, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: sholmstr@abo.fi. Research interests: hardware/software codesign, hardware description languages, reconfigurable computing systems.

Davide D'Incau, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: davide.dincau@abo.fi.

Jorma Jaakkola, M.Sc., the University of Turku, Mathematics. E-mail: joeija@utu.fi. Research interests: Markov operators.

Jonna Järveläinen, M.Sc., the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: jonna.jarvelainen@tukkk.fi. Research interests: electronic commerce in tourism industry and grocery shopping.

Antero Järvi, M.Sc., the University of Turku, Computer Science. E-mail: ajarvi@cs.utu.fi. Research interests: medical image analysis and compression.

Juha Kivijärvi, M.Sc., the University of Turku, Computer Science. E-mail: juhkivij@utu.fi. Research interests: image compression.

Antonina Kloptchenko, M.Sc Tech., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: akloptch@abo.fi

Eija Koskivaara, M.Sc., the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: eija.koskivaara@tukkk.fi. Research interests: information systems, neural networks and auditing.

Vladimir Kvassov, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: vkvassov@abo.fi.

Sébastien Lafond, Ingénieur en génie électrique, Åbo Akademi University, Department of Computer Science. E-mail: slafond@abo.fi

Tommi Laine, M.Sc., the University of Turku, Electronics and Information Technology. E-mail: tomila@utu.fi. Research interests: digital audio.

Timo Lainema, M.Sc., the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: timo.lainema@tukkk.fi. Research interests: business gaming, dynamic learning, environments, expenential learning.

Joonas Lehtinen, M.Sc. the University of Turku, Computer Science. E-mail: joonas.lehtinen@cs.utu.fi. Research interests: image compression (TUCS WWW-server).

Arto Lepistö, M.Sc., the University of Turku, Department of Mathematics. E-mail: alepisto@utu.fi. Research interests: combinatorics of words.

Jianming Liang, M.Sc., the University of Turku, Computer Science. E-mail: jianming.liang@utu.fi. Research interests: medical image analysis.

Péter Majlender, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: pmajlend@abo.fi.

Timo Mantere, M.Sc., the University of Vaasa, Department of Information Technology and Production Economics. E-mail: timo.mantere@uwasa.fi. Research interests: genetic algorithms based software testing methods, digital image processing.

Jan Manuch, M.Sc., the University of Turku. E-mail: manuch@cs.utu.fi. Research interests: combinatorics of words, formal languages and automata, discrete mathematics, communication complexity.

Tommi Meskanen, M.Sc., the University of Turku, Mathematics. E-mail: tommes@utu.fi. Research interests: cryptography, automata and formal language theory, computability.

Luka Milovanov, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: lmilovan@abo.fi.

Dirk Nowotka, M.Sc., the University of Turku, Department of Mathematics. E-mail: dnowotka@abo.fi.

Janne Näppi, M.Sc., the University of Turku, Computer Science. E-mail: jnappi@utu.fi. Research interests: medical imaging, especially mammographic image analysis.

Ion Petre, M.Sc., the University of Turku, Mathematics. E-mail: ipetre@cs.utu.fi. Research interests: combinatorics on words.

Luigia Petre, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: lpetre@abo.fi. Research interests: distributed systems focusing on mobility aspects, UML semantics and formalisation, hybrid and control systems, object and component-oriented programming.

Ivan Porres Paltor, M.Sc. tech., Åbo Akademi University, Department of Computer Science. E-mail: iporres@abo.fi. Research interests: Software engineering, UML, embedded systems.

Viorel Preoteasa, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: viorel.preoteasa@abo.fi. Research interests: Mathematical logic, Theoretical Computer Science, Programming languages, Data structures.

Jussi Puhakainen, M.Sc., the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: jussi.puhakaineni@tukkk.fi. Research interests: electronic commerce, support systems

Kalle Ranto, M.Sc., the University of Turku, Mathematics. E-mail: kalle.ranto@utu.fi. Research interests: algebraic coding theory.

Sanna Ranto, M.Sc., the University of Turku, Mathematics. E-mail: sanna.ranto@utu.fi. Research interests: coding theory.

Petri Rosendahl, M.Sc., the University of Turku, Mathematics. E-mail: perosen@utu.fi.

Ruggero Rossi de Mio, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: rrossi@abo.fi

Rimvydas Ruksenas, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: rruksena@abo.fi. Research interests: formal methods in the design of the asynchronous delay-insensitive VLSI circuits, mechanisation of the refinement calculus, interactive environments for proof and/or program construction.

Mauno Rönkkö, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: mronkko@abo.fi. Research interests: hybrid systems, action systems.

Matti Rönkä, M.Sc., the University of Turku, Mathematics. E-mail: matronka@utu.fi. Research interests: tree languages and term rewriting systems, automata and formal language theory.

Saeed P. Salehi, B.Sc., the University of Turku, Mathematics. E-mail: saeed@cs.utu.fi.

Tiberiu Seceleanu, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: tsecelea@abo.fi. Research interests: HW-SW codesign, asynchronous analysis.

Jouni Smed, M.Sc., the University of Turku, Computer Science. E-mail: jouni.smed@cs.utu.fi.

Elina Syrjänen, M.Sc., the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: elina.syrjanen@tukkk.fi. Research interests: medical informatics, business process reengineering.

Frank Tétard, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: frank.tetard@abo.fi.

Dragos Truscan, M.Sc, the Åbo Akademi University, Department of Computer Science. E-mail: dtruscan@abo.fi.

Victor Tsygankov, Master's student, Turku School of Economics and Business Administration. E-mail: victor.tsygankov@tukkk.fi

Pekka Turunen, M.Sc., the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: pekka.turunen@tukkk.fi. Research interests: evaluation of medical information systems.

Tuomas Valtonen, M.Sc., the University of Turku, Electronics and Information Technology. E-mail: tuomas.valtonen@utu.fi. Research interests: future communication systems.

Pentti Virtanen, M.Sc. the University of Turku, Computer Science. E-mail: Pentti.Virtanen@sci.fi. Research interests: measuring the software development process.

Seppo Virtanen, M.Sc., the University of Turku, Electronics and Information Technology. E-mail: seppo.virtanen@it.utu.fi. Research interests: embedded systems, communication protocols.

Tomi Westerlund, M.Sc., the University of Turku, Electronics and Information Technology. E-mail: tomi.westerlund@utu.fi.

Lu Yan, B.Sc., Åbo Akademi University, Department of Computer Science. E-mail: lyan@abo.fi.

## 4.6 TUCS Office

The following administrative staff has been employed by the TUCS office during 2000-2001:

Christel Donner, M.Soc.Sc., Administrative Officer, Financing. Started on April 1st 2000. E-mail: christel.donner@abo.fi.

Ulrika Gustafsson, M.Sc (econ.), Administrative Officer (maternity leave substitute), Financing. Started on August 6th 2001. E-mail: ugustafs@abo.fi.

Tomas Junnonen, TUCS lab engineer. Started on June 8th 2001. E-mail: tjunnone@abo.fi.

Nina Kivinen, Office Secretary, primarily responsible for updating the TUCS homepages. E-mail: nina.m.kivinen@abo.fi.

Tiina Lehto, M.A., Administrative Officer, Educational Affairs, Internal Information and Publicity. E-mail: tiina.lehto@abo.fi.

Leena Palmulaakso-Nylund, Grad. of commerc. institute, Office Secretary, General administration, Publication Series (On maternity leave since October 23rd 2000). E-mail: lpalmula@abo.fi.

Teemu Peltola, TUCS lab. Engineer. Started on June 18th 2001. E-mail: tesape@utu.fi.

Maria Prusila, Grad. of commerc. institute, Office Secretary, General Administration, Publication Series. Started at TUCS on October 16th 2000. E-mail: maria.prusila@abo.fi.

Thomas Sund, M.Soc.Sc., Administrative Officer, Educational Affairs, Internal Information and Publicity. E-mail: thomas.sund@abo.fi.

Monica Suomi, M.A., Project Secretary at TUCS until March 31st 2000.

# 5 Accepted Theses

During the yeas 2000 and 2001, the departments within TUCS have produced 17 Ph.D. theses and 5 Ph.Lic. theses:

## 5.1 Doctoral Theses

Martin Büchi, Safe Language Mechanisms for Modularization and Concurrency. Åbo Akademi, Department of Computer Science.

Jaakko Järvi, New Techniques in Generic Programming : C++ is More Intentional than Intended. University of Turku, Department of Computer Science.

Kalle Kangas, Five Stories on IT and Russian Trade; A Resource-Based View to Information Resources Management in Finland-Based Multinational Conglomerate. Turku School of Economics and Business Administration.

Linas Laibinis, Mechanised Formal Reasoning About Modular Programs. Åbo Akademi, Department of Computer Science.

Jan-Christian Lehtinen, Reproducing Kernel Splines in the Analysis of Medical Data. University of Turku, Department of Computer Science.

Jianming Liang, Dynamic Chest Images Analysis. University of Turku, Department of Computer Science.

Shuhua Liu, Improving Executive Support in Strategic Scanning with Software Agent Systems. Åbo Akademi University, Department of Information Systems.

Gábor Magyar, On Solution Approaches for Some Industrially Motivated Combinatorial Optimization Problems. University of Turku, Department of Computer Science.

Janne Näppi, Computer-Assisted Diagnosis of Breast Calcifications. University of Turku, Department of Computer Science.

Tiberiu Seceleanu, Systematic Design of Synchronous Digital Circuits. Åbo Akademi, Department of Computer Science.

Elena Troubitsyna, Stepwise Development of Dependable Systems. Åbo Akademi, Department of Computer Science.

Tero Aittokallio, Characterization and Modelling of the Cardiorespiratory System in Sleep-disordered Breathing. University of Turku, Department of Mathematics.

Timo Leino, Itsenäiskäytön johtaminen tietohallinnon osa-alueena. Turku School of Economics and Business Administration.

Kalle Parvinen, Adaptive metapopulation dynamics. University of Turku, Department of Mathematics.

Ivan Porres, Modeling and Analizing Software Behavior in UML. Åbo Akademi, Department of Computer Science.

Jussi Puhakainen, Electronic Business in Interactive Digital Networks - from Transactional toward Interactive Focus. Turku School of Economics and Business Administration.

Mauno Rönkkö, Stepwise Development of Hybrid Systems. Åbo Akademi, Department of Computer Science.

## 5.2 Licentiate Theses

Samuel Holmström, Hardware Design with Reconfigurable Computing Systems. Åbo Akademi, Åbo Akademi, Department of Computer Science.

Timo Lainema, Constructing a Real-Time Processed Business Game for Business Process Training. Turku School of Economics and Business Administration.

Tommi Meskanen, Äärellisiin automaatteihin perustuvista julkisen avaimen kryptosysteemeistä. University of Turku., Department of Computer Science.

Jussi Puhakainen, Challenges in Managing Electronic Commerce Systems. Turku School of Economics and Business Administration.

Pentti Virtanen, Issues of Improving Object-Oriented Software Development. University of Turku, Department of Computer Science.

# 6 Publications

TUCS has four publication series:

- TUCS Dissertation series (ISSN 1239-1883) contains doctoral dissertations by researchers affiliated with TUCS.
- TUCS Technical Report series (ISSN 1239-1891) contains technical reports from TUCS. This series is part of NCSTRL, the Networked Computer Science Technical Reports Library, administered by the Computer Science Department at the Cornell University.
- TUCS General Publication series (ISSN 1239-1905) contains all other publications from TUCS, like proceedings from conferences organized by TUCS, annual reports, etc.
- TUCS National Publication series (ISSN 1457-8301) is intended for similar types of publications as the general publication series, but the publication language is either Finnish or Swedish.

During the years 2000-2001 TUCS has published 13 dissertations, 115 technical reports, and 1 general publication. Most of the TUCS publications are available online in electronic format at the TUCS World Wide Web pages.

## 6.1 TUCS Dissertations

The following doctoral dissertations have been published in the TUCS Dissertation series during the years 2000 and 2001. The number refers to the publication number in the series.

23. Gábor Magyar, On Solution Approaches for Some Industrially Motivated Combinatorial Optimization Problems.

24. Linas Laibinis, Mechanised Formal Reasoning About Modular Programs.

25. Shuhua Liu, Improving Executive Support in Strategic Scanning with Software Agent Systems.

26. Jaakko Järvi, New Techniques in Generic Programming : C++ is More Intentional than Intended.

27. Jan-Christian Lehtinen, Reproducing Kernel Splines in the Analysis of Medical Data.

28. Martin Büchi, Safe Language Mechanisms for Modularization and Concurrency.

29. Elena Troubitsyna, Stepwise Development of Dependable Systems.

30. Janne Näppi, Computer-Assisted Diagnosis of Breast Calcifications.

31. Jianming Liang, Dynamic Chest Images Analysis. New Model-based Methods for Dynamic Pulmonary Imaging and Other Applications.

32. Tiberiu Seceleanu, Systematic Design of Synchronous Digital Circuits.

33. Tero Aittokallio, Characterization and Modelling of the Cardiorespiratory System in Sleep-disordered Breathing.

34. Ivan Porres, Modeling and Analizing Software Behavior in UML.

35. Mauno Rönkkö, Stepwise Development of Hybrid Systems.

## 6.2 TUCS Technical Reports

The following technical reports have been published in the TUCS Technical Reports series during the years 2000-2001. The number refers to the publication number in the series.

324. Timo Knuutila and Olli Nevalainen, Reduction Theorem for Weighted Grouping Problems

325. Mats Gyllenberg and Timo Koski, Probabilistic Models for Bacterial Taxonomy

327. Jouni Smed, Kari Salonen, Mika Johnsson, Tommi Johtela and Olli Nevalainen, A Comparison of Group and Minimum Setup Strategies in PCB Assembly

328. Robert Fullér and Peter Majlender, An Analytic Approach for Obtaining Maximal Entropy OWA Operator Weights

329. Juhani Karhumäki and Jan Manuch, Multiple Factorizations of Words and Defect Effect

330. Kristoffer Öström, Barbro Back, Hannu Vanharanta and Ari Visa, Descriptive Statistics on Companies in the Forest Products Industry

331. Iiro Honkala, Tero Laihonen and Sanna Ranto, On codes identifying sets of vertices in Hamming spaces

332. Arto Salomaa, Composition Sequences for Functions over a Finite Domain

333. Ralph-Johan Back, Anna Mikhajlova and Joakim von Wright, Class Refinement as Semantics of Correct Object Substitutability

334. Juha Honkala, A Kleene-Schützenberger Theorem for Lindenmayerian Rational Power Series

335. Jussi Puhakainen, Building and Managing an Electronic Commerce System - Case PC-SuperStore

336. Attila Gyenesei, A Fuzzy Approach for Mining Quantitative Association Rules

337. Ralph-Johan Back, Leonid Mikhajlov and Joakim von Wright, Formal Semantics of Inheritance and Object Substitutability

338. Helge G. Gyllenberg, Mats Gyllenberg, Timo Koski, Tatu Lund, Heikki Mannila and Christopher Meek, Singling out Ill-fit Items in a Classification. Application to the Taxonomy of Enterobacteriaceae

339. Odo Diekman, Mats Gyllenberg, Haiyang Huang, Markus Kirkilionis, J.A.J. Metz and Horst R. Thieme, On the Formulation and Analysis of General Deterministic Structured Population Models. II. Nonlinear Theory

340. Juha Honkala, Results Concerning E0L and C0L Power Series

341. Mats Gyllenberg, Timo Koski and Tatu Lund, Applying the EM-algorithm to Classification of Bacteria

342. Juhani Karhumäki and Ion Petre, On the Centralizer of a Finite Set

343. Ion Petre, The Difference Operation on Semilinear Power Series

344. Juha Honkala, A New Class of Algebraic Series Having a Decidable Equivalence Problem

345. Juha Honkala, A Polynomial Bound for Certain Cases of the D0L Sequence Equivalence Problem

346. Attila Gyenesei, Mining Weighted Association Rules for Fuzzy Quantitative Items

347. Juhani Karhumäki and L.P. Lisovik, A Simple Undecidable Problem: The Inclusion Problem for Finite Substitutions on $ab^*c$

349. Sanna Ranto, Iiro Honkala and Tero Laihonen, Two families of optimal identifying codes in binary Hamming spaces

350. Arto Salomaa, Compositions over a Finite Domain: from Completeness to Synchronizable Automata

351. Xiaocong Fan, Towards a Building Methodology for Software Agents

352. Juha Honkala, Zeros of Z-rational Sequences and Thin 0L Languages

353. Juha Honkala, On Infinite Words Generated by Polynomial D0L Systems

354. Tatjana Petkovic and Magnus Steinby, Piecewise Directable Automata

355. Christer Carlsson, Robert Fullér and Péter Majlender, A Possibilistic Approach to Selecting Portfolios with Highest Utility Score

356. Jussi Puhakainen and Pasi Malinen, European SMEs and Electronic Commerce - A Seller's Perspective in Business-to-Business Operations

357. Vesa Halava, Tero Harju and Mika Hirvensalo, Binary (Generalized) Post Correspondence Problem

358. Tero Harju and Juhani Karhumäki, Many Aspects of Defect Thoerems

359. Juhani Karhumäki, Some Open Problems in Combinatorics of Words and Related Areas

360. Juha Honkala and Arto Salomaa, Watson-Crick D0L Systems with Regular Triggers

361. Vesa Halava and Tero Harju, Mortality in Matrix Semigroups

362. Risto Lahdelma, Pekka Salminen and Markku Kuula, Testing the Efficiency of Pairwise Comparison Methods in Discrete Multiple Criteria Problems

363. Xu Li, and Johan Lilius, Checking Compositions of UML Sequence Diagrams for Timing Inconsistency

364. Alex Mateescu, Arto Salomaa, Kai Salomaa and Sheng Yu, On an Extension of the Parikh Mapping

365. Arto Salomaa, Synchronization of Finite Automata. Contributions to an Old Problem

366. Luigia Petre and Marina Waldén, Mobile Components as Topological Action Systems

367. Christer Carlsson and Robert Fullér, On Fuzzy Real Option Valuation

368. Attila Gyenesei, Fuzzy Partitioning of Quantitative Attribute Domains by a Cluster Goodness Index

369. Pekka Reijonen and Jukka Heikkilä, Invest in IT But Don't Forget the Organisation

370. Luigia Petre, Components vs. Objects

371. Tuija Nopola, Antero Järvi, Erkki Svedström and Olli Nevalainen, Segmenting Bones from Wristhand Radiographs

372. Ralph-Johan Back and Joakim von Wright, Contracts as Mathematical Entities in Programming Logic

373. Ralph-Johan Back and Joakim von Wright, Enforcing Behavior with Contracts

374. Ralph-Johan Back and Joakim von Wright, Verification and Refinement of Action Contracts

375. Tero Aittokallio, Mats Gyllenberg, Olli Nevalainen and Olli Polo, Testing for Periodicity in Signals: an Application to Detect Partial Upper Airway Obstruction during Sleep

376. Tero Harju, Oscar Ibarra, Juhani Karhumäki and Arto Salomaa, Decision Questions Concerning Semilinearity Morphisms and Commutation of Languages

377. Juha Plosila, Kaisa Sere and Marina Waldén, Component-Based Asynchronous Circuit Design in B

378. Jaakko Järvi and Gary Powell, The Lambda Library : Lambda Abstraction in C++

379. Tero Aittokallio and Esa Uusipaikka, Computation of Standard Errors for Maximum-likelihood Estimates in Hidden Markov Models

380. Tero Aittokallio, Olli Nevalainen, Jussi Tolvi, Kalle Lertola and Esa Uusipaikka, Computation of Restricted Maximum-penalized-likelihood Estimates in Hidden Markov Models

381. Jussi Jaakkola, Timo Leipälä and Olli Nevalainen, On the Stability of Pallet Loading Layouts

382. Juha Honkala, On Sparse 0L Languages over the Binary Alphabet

383. Juha Honkala, Easy Cases of the D0L Sequence Equivalence Problem

384. Tero Aittokallio, Olli Nevalainen, Pekka Ojala and Timo J. Nevalainen, Automated Detection of Differentially Expressed Fragments in mRNA Differential Display

385. Juha Honkala, Three Variants of the DT0L Sequence Equivalence Problem

386. Mika Hirvensalo, Computing with Quanta - Impacts of Quantum Theory on Computation

387. Juraj Hromkovic, Juhani Karhumäki, Hartmut Klauck, Georg Schnitger and Sebastian Seibert, Communication Complexity Method for Measuring Nondeterminism in Finite Automata

388. Vesa Halava and Tero Harju, Some New Results on Post Correspondence Problem and Its Modifications

389. Arto Salomaa, Uni-Transitional Watson-Crick D0L Systems

390. Arto Salomaa, Iterated Morphisms with Complementarity on the DNA Alphabet

391. Petteri Kaitovaara, Increasing Business-Relevancy to the IT Service Product with the Support of Packaging of IT Services

392. Tero Laakso, Mika Johnsson, Tommi Johtela, Jouni Smed and Olli Nevalainen, Estimating the Production Times in PCB Assembly

394. Kalle Ranto, New infinite families of 3-designs from the Z4-Goethals codes

395. Jonas Karlsson, Barbro Back, Hannu Vanharanta and Ari Visa, Financial Benchmarking of Telecommunications Companies

396. Tomas Eklund, Barbro Back, Hannu Vanharanta and Ari Visa, Benchmarking International Pulp and Paper Companies Using Self-Organizing Maps

397. Vesa Halava and Tero Harju, An Undecidability Result Concerning Periodic Morphisms

398. Kalle Parvinen, Evolutionary Branching of Dispersal Strategies in Structured Metapopulations

399. Mats Gyllenberg and Kalle Parvinen, Necessary and Sufficient Conditions for Evolutionary Suicide

400. Tommi Meskanen, Ari Renvall and Paula Steinby, Efficient Scalar Multiplication on Elliptic Curves

401. Tommi Meskanen, Ari Renvall and Paula Steinby, On Distrubuted Computing on Elliptic Curves

402. Tero Harju and Ion Petre, On Commutation and Primitive Roots of Codes

403. Tiberiu Seceleanu and Juha Plosila, Synchronous Pipeline Design in Action Systems

404. Tero Aittokallio, Mats Gyllenberg and Olli Polo, Adjustment of the Human Respiratory System to Increased Upper Airway Resistance during Sleep

405. Ping Yan, Global Asymptotical Stability of the Non-trivial Steady State of an Epidemic Model

406. Vesa Halava and Tero Harju, Infinite Solutions of Marked Post Correspondence Problem

407. Xiaocong Fan, On Splitting and Cloning Agents

408. Tommi Meskanen, On Finite Automaton Public Key Cryptosystems

409. Tero Harju, Decision Questions on Integer Matrices

410. Juha Honkala, The DF0L Language Equivalence Problem

411. Mats Gyllenberg, Timo Koski and Tatu Lund, BinClass: A Software Package for Classifying Binary Vectors User's Guide

412. Linas Laibinis and Joakim von Wright, Specification Variables: Between the Angel and the Demon

413. Juha Honkala, A Note on Uniform HDT0L Systems

414. Juha Honkala, On Images of D0L and DT0L Power Series

415. Bixin Li, A Hierarchical Slice-Based Framework for Object-Oriented Coupling Measurement

416. Bixin Li and Xiaocong Fan, JATO: Slicing Java Programs Hierarchically

417. Iiro Honkala, Tero Laihonen and Sanna Ranto, On Strongly Identifying Codes

418. Tero Laihonen and Sanna Ranto, Families of Optimal Codes for Strong Identification

419. Erzsébet Csuhaj-Varjú and Arto Salomaa, Networks of Watson-Crick D0L Systems

420. Juhani Karhumäki, Challenges of Commutation: An Advertisement

421. Carlos Martín-Vide, Gheorghe Pãun, Juan Pazoz and Alfonso Rodriguez-Paton, Tissue P Systems

422. Julien Cassaigne, Juhani Karhumäki and Ján Manuch, On Conjugacy of Languages

423. Pavol Duris and Ján Manuch, On the Computational Complexity of Infinite Words

424. Judit Csima, Erzsébet Csuhaj-Varjú and Arto Salomaa, Power and Size of Extended Watson-Crick L Systems

425. Tuomas Valtonen, Governmental Visions for Future Info-Communication - A Survey of the European Union, the United States and Japan

427. Juha Honkala, A New Bound for the Sequence Equivalence Problem of Polynomial D0L Systems

428. Stepan Holub and Juha Kortelainen, Linear Size Test Sets for Certain Commutative Languages

429. Robert Fullér and Péter Majlender, On Obtaining Minimal Variability OWA Operator Weights

430. Jonas Karlsson, Barbro Back, Hannu Vanharanta and Ari Visa, Analysing Financial Performance with Quarterly Data Using Self-Organising Maps

431. Luis Alvarez, Mats Gyllenberg and Larry Shepp, Optimal Harvesting in the Presence of Density-Dependent Extinction Probabilities

432. Tero Harju and Dirk Nowotka, On the Independence of Equations in Three Variables

433. S.A.H. Geritz, M. Gyllenberg, F.J.A. Jacobs and K. Parvinen, Invasion Dynamics and Attractor Inheritance

434. T.J. De Jong and S.A.H. Geritz, The Role of Geitonogamy in the Gradual Evolution To Dioecy in Cosexual Plants

435. Tero Harju and Dirk Nowotka, On the Density of Critical Factorizations

436. Luigia Petre, Elena Troubitsyna, Marina Waldén, Pontus Boström, Niklas Engblom and Micaela Jansson, A Methodology for Integration of Formal Methods in a Healthcare Case Study

437. Luigia Petre, Mauno Rönkkö, Elena Troubitsyna, Marina Waldén and Micaela Jansson, A Methodology for Co-design Based on a Healthcare Case Study

438. Mats Gyllenberg, Timo Koski, Peter Dawyndt, Tatu Lund, Fabiano Thompson, Brian Austin and Jean Swings, New Methods for the Analysis of Binarized BIOLOG GN Data of Vibrio Species: Minimization of Stochastic Complexity and Cumulative Classification

## 6.3 TUCS General Publications

The following general publications have been published in the TUCS General Publication series during the years 2000-2001. The number refers to the publication number in the series.

18. Ralph-Johan Back, Timo Järvi, Nina Kivinen, Leena Palmulaakso-Nylund, Thomas Sund, Turku Centre for Computer Science, Annual Report 1999.

## 6.4 International Publications

Bibliographical information about all publications by the researchers at TUCS is available at the TUCS web pages. This information is based on a large bibliographic database in BibTeX format, which can be viewed in different ways, e.g. by research group or laboratory, by publication type (book, journal paper, article in conference proceeding, technical report, Ph.D. thesis) and by year, or any combination of these. It is also possible to search for all publications by one author.

Table 1 shows the publication record of TUCS for the period 1994-2001 in more detail. Summarizing, the researchers at TUCS have during these years published 31 books (monographs) in international publication series. They have published close to 700 articles in international refereed journals and about 1000 full articles in international refereed conferences or edited books. The conferences and edited books are very important in our field of research and have a high status as a publication forum, because of the need for fast turnaround of information. The total number of publications by TUCS researchers during this period, including technical reports and publications in national series, is about 2400.

In addition, many of the TUCS researchers are editors of scientific journals and monograph series and regularly serve in the program committees of leading international conferences.

| ***Type of publication*** | ***Nr. of publ.*** |
|---|---|
| Books (monographs) | 31 |
| Chapter in books | 200 |
| Journal articles | 694 |
| Articles in conference proceedings | 818 |
| Ph.D. thesis | 49 |
| Technical reports | 611 |
| **Total** | **2403** |

**Table 1. Scientific publications from researchers in TUCS 1994–2001**

## 6.5 Publications by TUCS Researchers 2000-2001

This section contains a list of all publications by researchers at TUCS during the years 2000-2001, organized by research group and type of publication. The information is gathered from the bibliographical database of TUCS.

### 6.5.1 Algorithmics Group

#### Ph. D. thesis

1. Jaakko Järvi. *New Techniques in Generic Programming: C++ is More Intentional than Intended*. PhD thesis, University of Turku, jun 2000.
2. Jan-Christian Lehtinen. *Reproducing Kernel Splines in the Analysis of Medical Data*. PhD thesis, University of Turku, may 2000.
3. Jianming Liang. *Dynamic Chest Images Analysis*. Dissertation, University of Turku, Turku Centre for Computer Science, dec 2000.
4. Gábor Magyar. *On Solution Approaches for Some Industrially Motivated Combinatorial Optimization Problems*. PhD thesis, University of Turku, mar 2000.
5. Janne Näppi. *Computer-Assisted Diagnosis of Breast Calcifications*. PhD thesis, University of Turku, oct 2000.
6. Tero Aittokallio. *Characterization and Modelling of the Cardiorespiratory System in Sleep-disordered Breathing*. PhD thesis, University of Turku, jun 2001.

#### Chapter in book

1. Jouni Smed, Mika Johnsson, Tommi Johtela, and Olli Nevalainen. Techniques and applications of production planning in electronics manufacturing systems. In C. T. Leondes, editor, *Computer-Aided Design, Engineering and Manufacturing (CADEM) Systems Techniques*. Gordon and Breach, 2000.

#### Journal articles

1. Tero Aittokallio, Mats Gyllenberg, Jaakko Järvi, and Olli Nevalainen. Detection of high-frequency respiratory movements during sleep. *Computer Methods and Programs in Biomedicine*, 61(3): 171–185, mar 2000.
2. Tero Aittokallio, Pekka Ojala, Timo J. Nevalainen, and Olli Nevalainen. Analysis of similarity of electrophoretic patterns in mRNA differential display. *Electrophoresis*, 21(14): 2947–2956, aug 2000.
3. Abraham Bookstein, Shmuel Klein, and Timo Raita. Simple bayesian model for bitmap compression. *Information Retrieval*, 1: 315 – 328, 2000.
4. Pasi Fränti, Helge Gyllenberg, Mats Gyllenberg, Juha Kivijärvi, Timo Koski, Tatu Lund, and Olli Nevalainen. Minimizing stochastic complexity using local search and GLA with applications to classification of bacteria. *BioSystems*, 57(1): 37 – 48, jun 2000.
5. Pasi Fränti, Timo Kaukoranta, Day-Fann Shen, and Kuo-Shu Chang. Fast and memory efficient implementation of the exact PNN. *IEEE Transactions on Image Processing*, 9(5): 773–777, may 2000.
6. Pasi Fränti and Juha Kivijärvi. Randomised local search algorithm for the clustering problem. *Pattern Analysis & Applications*, 3(4): 358–369, dec 2000.

7. Viliam Geffert, Jyrki Katajainen, and Tomi Pasanen. Asymptotically efficient in-place merging. *Theoretical Computer Science*, 237: 159 – 181, 2000.
8. Mats Gyllenberg, Timo Koski, Tatu Lund, and Olli Nevalainen. Clustering by adaptive local search with multiple search operators. *Pattern Analysis and Applications*, 3(4): 348 – 357, 2000.
9. Timo Häyrinen, Mika Johnsson, Tommi Johtela, Jouni Smed, and Olli Nevalainen. Scheduling algorithms for computer-aided line balancing in printed circuit board assembly. *Production Planning & Control*, 11(5): 497–510, 2000.
10. Joonas Hokkanen, Risto Lahdelma, and Pekka Salminen. Multicriteria decision support in a technology competition for cleaning polluted soil in helsinki. *Journal of Environmental Management*, 60(4): 339–348, 2000.
11. Tommi Johtela, Jouni Smed, Mika Johnsson, and Olli Nevalainen. A fuzzy approach for modeling multiple criteria in the job grouping problem. *Computers & Industrial Engineering*, 2000.
12. Timo Kaukoranta, Pasi Fränti, and Olli Nevalainen. A fast exact GLA based on code vector activity detection. *IEEE Transactions on Image Processing*, 9(8): 1337–1342, aug 2000.
13. Risto Lahdelma, Pekka Salminen, and Joonas Hokkanen. Using multicriteria methods in environmental planning and management. *Environmental Management*, 26(6): 595–605, 2000.
14. Gabor Magyar, Mika Johnsson, and Olli Nevalainen. An adaptive hybrid genetic algorithm for the 3-matching problem. *IEEE Trnas on Evolutionary Computation*, 4(2), jul 2000.
15. Gabor Magyar, Mika Johnsson, and Olli Nevalainen. On solving single machine optimisation problems in electronics assembly. *Journal of Electronic Manufacturing*, 2000.
16. Tiina Ojala, Janne Näppi, and Olli Nevalainen. Accurate segmentation of the breast region from digitized mammograms. *Computerized Medical Imaging and Graphics*, 2000.
17. Jouni Smed, Tommi Johtela, Mika Johnsson, Mikko Puranen, and Olli Nevalainen. An interactive system for scheduling jobs in electronic assembly. *Internationl Journal of Advanced Manufacturing Technology*, 16(6): 450–459, 2000.
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20. Tero Aittokallio, Mats Gyllenberg, Olli Nevalainen, and Olli Polo. Testing for periodicity in signals: an application to detect partial upper airway obstruction during sleep. *Journal of Theoretical Medicine*, 3(4): 231–245, dec 2001.
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22. Tero Aittokallio, Pekka Ojala, Timo J. Nevalainen, and Olli Nevalainen. Automated detection of differentially expressed fragments in mRNA differential display. *Electrophoresis*, 22(10): 1935–1945, jun 2001.
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26. Mika Johnsson and Jouni Smed. Observations on PCB assembly optimization. *Electronic Packaging & Production*, 41(5): 38–42, may 2001.
27. Timo Knuutila, Mikko Puranen, Mika Johnsson, and Olli Nevalainen. Three perspectives for solving the job grouping problem. *International Journal of Production Research*, 39(18): 4261–4280, 2001.

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29. Simo Makkonen and Risto Lahdelma. Analysis of power pools in the deregulated energy market through simulation. *Decision Support Systems*, 30(3): 289–301, 2001.
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1. Jarmo T. Alander and Timo Mantere. Genetic algorithms in automatic software testing - analysing a faulty bubble sort routine. In Heikki Hyötyniemi, editor, *SteP 2000 – Millennium of Artificial Intelligence, The 9th Finnish Artificial Intelligence Conference*, volume 2 of *Publications of the Finnish Artificial Intelligence Society – 16*, pages 23–32, Espoo, Finland, aug 2000. Finnish Artificial Intelligence Society.
2. Jarmo T. Alander and Timo Mantere. Genetic algorithms in software testing - experiments with temporal target functions. In *MENDEL2000 6th International Conference on Soft Computing*, pages 9–14, Brno, Check Republic, jun 2000. PC-DIR, Brno.
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10. Timo Knuutila, Mikko Puranen, Mika Johnsson, and Olli Nevalainen. Exact solution of the job grouping problem by constraint programming. In *Proceedings of the Group Technology/Cellular Manufacturing World Symposium - Year 2000*, pages 125–130, 2000.
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16. Attila Gyenesei. Determining fuzzy sets for quantitative attributes in data mining problems. In Nikos Mastorakis, editor, *Advances in Fuzzy Systems and Evolutionary Computation*, Artificial Intelligence Series, A Series of Reference Books and Textbooks, pages 48–53. World Scientific Engineering Society (WSES), feb 2001.
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25. Timo Mantere and Jarmo Alander. Testing a structural light vision software by genetic algorithms - estimating the worst case behavior of volume measurement. In David P. Casasent and Ernest L. Hall, editors, *Intelligent Robots and Computer Vision XX:*

*Algorithms, Techniques, and Active Vision*, volume SPIE-4572, pages 466–475, Bellingham, Washington, USA, oct 2001. SPIE Press.
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## Technical reports

1. Tero Aittokallio, Mats Gyllenberg, Olli Nevalainen, and Olli Polo. Testing for periodicity in signals: an application to detect partial upper airway obstruction during sleep. Technical Report 375, TUCS - Turku Centre for Computer Science, Turku, Finland, nov 2000.
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3. Tero Aittokallio, Olli Nevalainen, Jussi Tolvi, Kalle Lertola, and Esa Uusipaikka. Computation of restricted maximum-penalized-likelihood estimates in hidden Markov models. Technical Report 380, TUCS - Turku Centre for Computer Science, Turku, Finland, nov 2000.
4. Tero Aittokallio and Esa Uusipaikka. Computation of standard errors for maximum-likelihood estimates in hidden Markov models. Technical Report 379, TUCS - Turku Centre for Computer Science, Turku, Finland, nov 2000.
5. Attila Gyenesei. A fuzzy approach for mining quantitative association rules. Technical Report 336, TUCS - Turku Centre for Computer Science, Turku, Finland, mar 2000.
6. Attila Gyenesei. Fuzzy partitioning of quantitative attribute domains by a cluster goodness index. Technical Report 368, TUCS - Turku Centre for Computer Science, Turku, Finland, oct 2000.
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16. Olli Virmajoki, Pasi Fränti, and Timo Kaukoranta. Iterative shrinking method for the clustering problem. Technical report, University of Joensuu, Department of Computer Science, 2001.

### 6.5.2 Biomathematical Research Group

#### Ph.D. thesis

1. Tero Aittokallio. *Characterization and Modelling of the Cardiorespiratory System in Sleep-disordered Breathing*. PhD thesis, University of Turku, jun 2001.
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1. Mats Gyllenberg, Ilkka Hanski, and T. Lindström. Adjustable reproductive strategies under predation. In J.A.J. Metz U. Dieckmann, editor, *Advances in adaptive dynamics*. Cambridge University Press, 2000.
2. Mats Gyllenberg, Timo Koski, and Tatu Lund. Applying the EM-algorithm to classification of bacteria. In F. Naghdy, F. Kurfess, H. Ogata, E. Szczerbicki, H. Bother, and H. Tlanfield, editors, *Proceedings of the International ICSC congress on Intelligent Systems and Applications, Vol. 2*, pages 65–71. Natural & Artificial Intelligence Systems Organisation, 2000.

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1. Tero Aittokallio, Mats Gyllenberg, Jaakko Järvi, and Olli Nevalainen. Detection of high-frequency respiratory movements during sleep. *Computer Methods and Programs in Biomedicine*, 61(3): 171–185, mar 2000.

2. Tero Aittokallio, Pekka Ojala, Timo J. Nevalainen, and Olli Nevalainen. Analysis of similarity of electrophoretic patterns in mRNA differential display. *Electrophoresis*, 21(14): 2947–2956, aug 2000.
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9. Pasi Fränti, Helge Gyllenberg, Mats Gyllenberg, Juha Kivijärvi, Timo Koski, Tatu Lund, and Olli Nevalainen. Minimizing stochastic complexity using local search and GLA with applications to classification of bacteria. *BioSystems*, 57(1): 37 – 48, jun 2000.
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5. B. Breite, Pirkko Walden, and Hannu Vanharanta. C-commerce virtuality – will it work in the internet? In *SSGRR 2000 Computer & eBusiness Conference*, L'Aquila, Italy, jul 2000.
6. R Breite and H Vanharanta. Technology driven change in supply chain management. In *Proceedings of the Eleventh International Working Seminar on Production Economics*, pages 47–69, Igls, Innsbruck, 2000.
7. R Breite and H Vanharanta. Validation of the internet applications in purchasing situation. In *Proceedings of the 9th International Annual IPSERA Conference and the third Annual North American Research Symposium on Purchasing and Supply Chain Management*, pages 89–98, London, Canada, 2000.
8. R Breite and P Walden mfl. IC-commerce virtuality- will it work in the internet? In *SSGRR 2000 Computer & eBusiness Conference*, L'Aquila, Italy, jul 2000.
9. Christer Carlsson and Robert Fullér. A fuzzy approach to taming the bullwhip effect. In *Proceedings of the Symposium on Computational Intelligence and Learning*, pages 42–49, Chios, Greece, jun 2000.
10. Christer Carlsson and Robert Fullér. A fuzzy approach to the bullwhip effect. In *Cybernetics and Systems '2000, Proceedings of the Fifteenth European Meeting on Cybernetics and Systems Research*, pages 228–233, Vienna, 2000. Austrian Society for Cybernetic Studies. Best Paper Award.
11. Christer Carlsson and Robert Fullér. Real option evaluation in fuzzy environment. In *Proceedings of the International Symposium of Hungarian Researchers on Computational Intelligence*, pages 69–77, Budapest, nov 2000. Budapest Polytechnic.
12. Christer Carlsson and Pirkko Walden. Mobile commerce: The next generation e-commerce impact on intelligent decision support. In Pascal Zaraté, editor, *Is the Electronic Business a Challenge for DSS? Proceedings of the 11th Meetings of the Euro Working Group on Decision Support Systems*, pages 22–26, Toulouse, France, 2000.
13. Markku Heikkilä and Hannu Vanharanta. GIGASYS - a dynamic decision support platform for giga investments. In P.Zaraté, editor, *Is electronic business a challenge for DSS? The 11th Meeting of the Euro Working Group on DSS*, Toulouse, France, jun 2000.
14. M. Koskinen and Hannu Vanharanta. Tacit knowledge as part of engineers´competence. In *Proceedings of the Symposium; Extra Skills for Engineers*, Maribor, Slovenia, oct 2000.
15. M. Koskinen and Hannu Vanharanta. Utilisation of tacit knowledge in project operations. In *15th IPMA World Conference*, London, UK, may 2000.
16. M. Koskinen and Hannu Vanharanta. Utilization of tacit knowledge in small technology firms. In *Proceedings of the 7th International Conference: Human Aspects of Advanced Manufacturing: Agility & Hybrid Automation III*, Krakow, Poland, 2000.
17. Vladimir Kvassov. Strategic decisions and intelligent tools. In *Proceedings of the 33rd Annual Hawaii International Conference on System Sciences*, Maui, Hawaii, jan 2000. IEEE Computer Society.
18. Vladimir Kvassov and Franck Tétard. Impacts of information technology on temporal dimensions of managerial work and its productivity. In *Proceedings of the 5-th AIM Conference, Montpellier, France,*, nov 2000.
19. Timo Lainema. Experiences on using a business game as part of an information systems course. In Camille Rogers, editor, *Proceedings of the 15th Annual Conference of ICIS, Brisbane, Australia*, pages 221–232. Georgia Southern University, dec 2000.
20. Shuhua Liu. Agent based scanning and interpretation system: Impacts on managers and their strategic scanning activities. In *Proceedings of the 2000 Americas Conference on Information Systems (AMCIS 2000)*, Long Beach, California, USA, aug 2000.
21. Shuhua Liu. Making sense of the business environment with the help of intelligent agents. In *Proceedings of ITBM2000- International Conference on Information Technology for Business Management, Worlds Computer Congress 2000*, Beijing,China, aug 2000.
22. Péter Majlender. OWA operators with maximal entropy. In *Proceedings of the International Symposium of Hungarian Researchers on Computational Intelligence*, pages 141–151, 2000.

23. M. Salo and Hannu Vanharanta. Intuitive strategy development process-a new theoretical approach. In *Proceedings of the Eleventh International Working Seminar on Production Economics*, pages 475–493, Igls, Innsbruck, 2000.
24. Franck Tétard. Fragmentation of working time and SMARTER IS-solutions. In *Proceedings of the Thirty-Third Annual Hawaii International Conference on System Sciences*, 2000.
25. Franck Tétard. Improving decision support with push technology-based tools: an implementation for internal logistics and material flow control problems. In *Americas Confence of Information Systems (AMCIS)*, 2000.
26. A. Visa, J. Toivonen, Barbro Back, and Hannu Vanharanta. Improvements on a knowledge discovery methodology for text documents. In *SSGRR 2000, Computer & eBusiness Conference*, L'Aquila, Italy, jul 2000.
27. A. Visa, J. Toivonen, Barbro Back, and Hannu Vanharanta. A new methodology for knowledge retrieval from text documents. In Yliniemi and Juuso, editors, *Proceedings of TOOLMET 2000 Symposium - Tool Environments and Development Methods for Intelligent Systems*, pages 147–151, Oulu, Finland, apr 2000.
28. A. Visa, J. Toivonen, Barbro Back, and Hannu Vanharanta. Toward text understanding - classification of text documents by word map. In Dasarathy, editor, *Proceedings of SPIE, Data Mining and Knowledge Discovery: Theory, Tools and Technology II*, volume 4057, pages 299–305, Florida, USA, 2000.
29. A. Visa, J. Toivonen, P. Ruokonen, Hannu Vanharanta, and Barbro Back. Knowledge discovery from text documents based on paragraph maps. In *Proceedings of the 33rd Annual Hawaii International Conference on Systems Science*, 2000.
30. A. Visa and J. Toivonen mfl. Data mining of text in authorship attribution. In *15th SPIE Annual International Symposium on AeroSense/Defence Sensing, Simulation and Controls. Data Mining and Knowledge Discovery: Theory, Tools and Technology II*, USA, 2000.
31. Pirkko Walden and Bill Anckar. A roundtrip to toulouse, please. self-booking low complexity travel products. In Pascal Zaraté, editor, *Is the Electronic Business a Challenge for DSS? Proceedings of the 11th Meetings of the Euro Working Group on Decision Support Systems*, pages 32–36, Toulouse, France, jul 2000.
32. Christer Carlsson and Robert Fullér. On optimal investment timing with fuzzy real options. In *Proceedings of the EUROFUSE 2001 Workshop on Preference Modelling and Applications*, pages 235–239, Granada, Spain, apr 2001.
33. Christer Carlsson and Robert Fullér. Reducing the bullwhip effect by means of intelligent, soft computing methods. In *Proceedings of the 34-th Hawaii International Conference on System Sciences (HICSS-34)*, Island of Maui, Hawaii, USA, jan 2001. Proceedings on CD-Rom, file name: DTISA06, 10 pages.
34. Christer Carlsson, Robert Fullér, and Péter Majlender. Project selection with fuzzy real options. In *Proceedings of the Second International Symposium of Hungarian Researchers on Computational Intelligence*, pages 81–88, Budapest, nov 2001.
35. Jonas Karlsson, Tomas Eklund, Barbro Back, Hannu Vanharanta, and Ari Visa. Transforming passive information from the internet into refined information using self-organising maps. In A. I. Morch S. Bjornestad, R. E. Moe and A. L. Opdahl, editors, *Proceedings of the 24th Information Systems Research Seminar in Scandinavia (IRIS24)*, volume 1, pages 541–554, aug 2001.
36. Antonina Kloptchenko and Barbro Back. Toward computer understanding: Information retrieval approaches overview. In *24th Information Systems Research Seminar in Scandinavia*, volume 2, pages 411–419, aug 2001.
37. Vladimir Kvassov. Personality types of managers in development of intelligent systems. In *In Proc. of the 10-th conference on Information System Development*. Kluwer Academic Publishers, London, U.K, sep 2001.
38. Vladimir Kvassov and Franck Tétard. Impacts of office information technology on managerial work's temporal dimensions and productivity: a descriptive study. In *In Proc.*

*of the Seventh Americas Conference on Information Systems, AMCIS'2001*, Boston, U.S., aug 2001.
39. Timo Lainema. How to apply process-oriented business gaming to information systems curriculum. In Elena Musci, editor, *On the Edge of the Millennium: a New Foundation for Gaming Simulation*, the proceedings of the 32nd Annual Conference of International Simulation and Gaming Association, pages 106–111. B.A. Graphics, Bari, Italy, sep 2001. Includes only abstracts, full papers published later.
40. Franck Tétard. Tackling fragmentation of working time with mobile decision support and data warehousing. In *ISDSS'01 - International Society for Decision Support Systems - 6th International Conference*, London, jul 2001.

**Technical reports**

1. Bill Anckar, Svante Olofsson, and Pirkko Walden. Agents as agents: A virtual assistant for self-bookings in travel. Technical Report 4, Institute for Advanced Management Systems Research, 2000.
2. Bill Anckar and Pirkko Walden. Designing internet reservation and management software systems for small peripheral hospitality rganizations: The HotMot solution. Technical Report 5, Institute for Advanced Management Systems Research, 2000.
3. Christer Carlsson and Robert Fullér. On fuzzy real option valuation. Technical Report 367, TUCS - Turku Centre for Computer Science, Turku, Finland, oct 2000.
4. Christer Carlsson and Robert Fullér. Reducing the bullwhip effect by means of intelligent, soft computing methods. Technical Report 3, Institute for Advanced Management Systems Research, 2000.
5. Christer Carlsson, Robert Fullér, and Péter Majlender. A possibilistic approach to selecting portfolios with highest utility score. Technical Report 355, TUCS - Turku Centre for Computer Science, Turku, Finland, nov 2000.
6. Robert Fuller and Peter Majlender. An analytic approach for obtaining maximal entropy OWA operator weights. Technical Report 328, TUCS - Turku Centre for Computer Science, Turku, Finland, jan 2000.
7. Tarja Meristö and Annukka Leppänen-Turkula mfl. Packaging 2020, future scenarios for finnish packaging branch. Technical Report 48, PTR Report, 2000.
8. Kristoffer Öström, Barbro Back, Hannu Vanharanta, and Ari Visa. Descriptive statistics on companies in the forest products industry. Technical Report 330, TUCS - Turku Centre for Computer Science, Turku, Finland, feb 2000.
9. Tomas Eklund, Barbro Back, Hannu Vanharanta, and Ari Visa. Benchmarking international pulp and paper companies using self-organizing maps. Technical Report 396, TUCS - Turku Centre for Computer Science, Turku, Finland, apr 2001.
10. Robert Fullér and Péter Majlender. On obtaining minimal variability OWA operator weights. Technical Report 429, TUCS - Turku Centre for Computer Science, Turku, Finland, nov 2001.
11. Jonas Karlsson, Barbro Back, Hannu Vanharanta, and Ari Visa. Financial benchmarking of telecommunications companies. Technical Report 395, TUCS - Turku Centre for Computer Science, Turku, Finland, apr 2001.
12. Vladimir Kvassov. Personality types of managers in development of intelligent systems. Technical Report 1, Institute for Advanced Management System Research, apr 2001.
13. Franck Tétard. Improving project management with web-based information systems: a case study. Research Report 4, IAMSR, 2001.

### 6.5.11 Research in Applied Artificial Intelligence

**Journal articles**

1. Timo Mantere and Jarmo T. Alander. Automatic test image generation by genetic algorithms for testing halftoning methods. *Arpakannus*, 1/2001: 39–44, may 2001. Special issue on Bioinformatics and Genetic Algorithms.

**Articles in conference proceedings**

1. Jarmo T. Alander and Timo Mantere. Genetic algorithms in automatic software testing - analysing a faulty bubble sort routine. In Heikki Hyötyniemi, editor, *SteP 2000 – Millennium of Artificial Intelligence, The 9th Finnish Artificial Intelligence Conference*, volume 2 of *Publications of the Finnish Artificial Intelligence Society – 16*, pages 23–32, Espoo, Finland, aug 2000. Finnish Artificial Intelligence Society.
2. Jarmo T. Alander and Timo Mantere. Genetic algorithms in software testing - experiments with temporal target functions. In *MENDEL2000 6th International Conference on Soft Computing*, pages 9–14, Brno, Check Republic, jun 2000. PC-DIR, Brno.
3. Timo Mantere and Jarmo T. Alander. Automatic test image generation by genetic algorithms for testing halftoning methods. In David P. Casasent, editor, *Intelligent Systems and Advanced Manufacturing: Intelligent Robots and Computer Vision XIX: Algorithms, Techniques, and Active Vision*, volume SPIE-4197, pages 297–308, Boston, nov 2000. SPIE, Bellingham, Washington.
4. Timo Mantere and Jarmo Alander. Testing a structural light vision software by genetic algorithms - estimating the worst case behavior of volume measurement. In David P. Casasent and Ernest L. Hall, editors, *Intelligent Robots and Computer Vision XX: Algorithms, Techniques, and Active Vision*, volume SPIE-4572, pages 466–475, Bellingham, Washington, USA, oct 2001. SPIE Press.
5. Timo Mantere and Jarmo T. Alander. Automatic software testing by genetic algorithms - introduction to method and consideration of possible pitfalls. In R. Matousek and P. Osmera, editors, *MENDEL2001 7th International Conference on Soft Computing*, pages 19–23. Kuncik, Brno, Check Republic, jun 2001.
6. Timo Mantere and Jarmo T. Alander. Automatic test image generation by genetic algorithms for testing halftoning methods - comparing results using wavelet filtering. In J. Tanskanen and J. Martikainen, editors, *Proceedings of the 2001 Finnish signal processing symposium FINSIG'01*, pages 55–58, Helsinki University of Technology, Espoo, Finland, jun 2001. IEEE Finland Section, Espoo.

# 7 Courses and seminars

The collection of advanced level and research courses, given in English, forms a central part of the TUCS Graduate School. Approximately 30 courses on this level are given each year, mostly as part of the ordinary teaching duties of the TUCS faculty and researchers. The courses can be taken by all TUCS students (and also M.Sc. students at the departments), independently of which department or university they belong to.

The following courses have been given during the year. The courses are classified into the main research areas of TUCS as follows:

A - Algorithmics
DM - Discrete Mathematics
ETC – Electronics and Telecommunication
ES - Embedded Systems
IS - Information Systems
MM – Mathematical Modeling
SE - Software Engineering

## 7.1 General Courses

**Academic Writing,** 2 credits, Gordon Alford, University of Turku. Spring 2000.
*Contents*: Writing constitutes a signifiant portion of scientific publication. This course covers various aspects of scientific writing and editing. It focuses structural and stylistic use of English with respect to scientific research.
*Components*: Lectures 20 h and course assignment.

**Advanced Computer Architecture,** 4-5 credits, A, Timo Järvi, University of Turku, Department of Computer Science. Spring 2001.
*Contents*: The course introduces architectural structures used in supercomputers. An important topic is how the speed of CPU and arithmetic-logic units can be increased. In addition, different kinds of parallel and vector processors are studied.
*Components*: lectures (56 h), exercises (14 h), assignment, examination.
*Literature*:

- Hwang, K. Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill, 1993.
- D. Sima, T. Fountain, P. Kacsuk. Advanced Computer Architectures, A Design Space Approach, Addison-Wesley, 1997.

**Advanced Course in Computer Networks and Internets**, 3 credits, SE, Aulis Pirinen, Åbo Akademi, Department of Computer Science. Fall 2001.
*Contents*: The course points to give an extensive and thorough knowledge of computer networks, global TCP/IP-Internet and of interworking between different nets. Functions, componets and structures of computer networks are therein dealt with. Especially Internet with its architecture, TCP/IP protocols and management is considered. Moreover, issues of security, new high-speed transfer techniques, network extensions and software implementation principles are treated.
*Components*: Lectures 28 h, exercise hours 8 h, a lot of small assignments and a quite large well-reported project work. No examinations are required if all assignments and the project

work are done personally in a given time and passed by fair marks (not less than 3/5). The students can propose their own project works.

*Literature*:

- Douglas E. Comer: Internetworking with TCP/IP, Volume 1: Principles, Protocols, and Architecture, 4th Edition (Prentice Hall 2000).

**Advanced Course on Databases**, 3 credits, A, Jukka Teuhola, University of Turku. Spring 2000.

*Contents*: The course explains several features of modern database management systems, such as query processing, concurrency control, recovery and security. The database design process is also an important topic. Distributed databases, as well as deductive databases, are briefly introduced. A large part of the course is devoted to object-oriented databases: the related data model, storage architecture, languages, existing systems and applications.

*Components*: lectures (52 h), examination.

*Literature*:

- R. Elmasri and S.B. Navathe: Fundamentals of Database Systems, 2nd ed., Benjamin/ Cummings, 1994.
- R.G.G. Cattell: Object Data Management, Object-Oriented and Extended Relational Database Systems, Revised ed., Addison-Wesley, 1994.

**Advanced Course on Data Structures**, 3 credits, A, Timo Raita, University of Turku, Department of Computer Science. Spring 2001.

*Contents*: The course concentrates of various data structures supporting fast search and update operations. The structures are studied from two perspectives. From the theoretical point of view, we analyse their performance using a given model of computation. The practical point of view concentrates of the usability of the structures in a given application. The purpose of the course is to study each structure in depth and to give the student the ability to choose an appropriate data representation for a given problem.

*Components*: lectures (52 h), examination.

*Literature*:

- T.H. Cormen, C.E. Leiserson and R.L. Rivest: Introduction to Algorithms, MIT Press, 1990.
- G.H. Gonnet and R. Baeza-Yates: Handbook of Algorithms and Data Structures (2nd Edition), Addison-Wesley, 1991.

**Advanced IT in Accounting**, 5 credits, IS, Barbro Back, Åbo Akademi University. Spring 2000, 2001.

*Contents*: The course focuses on advanced information technologies in accounting and auditing. It encompasses the methods of online analytical processing (OLAP), expert systems (ES), neural networks (NN), and genetic algorithms (GA). The course deals with central problems within accounting and auditing (analyses of financial performance; predictions of corporate bankruptcies; datamining accounting numbers, effective and efficient analytical review processes in internal control and auditing) using expert systems, neural networks and genetic algorithms as support aid.

*Components*:

1. In the spring term (I period) lectures and cases 20h
2. In the spring term (II period) development project 8 h

*Examination*: Lectures, cases and written exam 3 credits, project 2 credits

*Literature*:

- Articles according to teacher's instructions and use of OLAP, ES, NN and GA-programs.

**Advanced Programming Laboratory Course,** 5 credits, ES, SE, Kaisa Sere, Åbo Akademi University. Fall 2000, 2001.

*Contents*: During this course an entire software project is carried through by a closely cooperating group of students. The main purpose is to study the software process as a whole, starting with the analysis of customer's demands and ending with running and documenting the produced software product. Special emphasis this term is put on designing software for product families. A major goal of the course is to enable better judgment where and when methodological aid is useful. Attention is given to methodological aid to communication and interaction within the group, that is, between the cooperating students, but also to convince the "customer" (typically the lecturer) that the resulting program meets the expectations. Within a laboratory course, students cooperate in groups of 3-6 persons, solving a single problem as a quite independent team. The laboratory course is an opportunity to gather experience with both managing and participating in a larger project and to learn how to improve the extendibility, maintainability and reusability of the resulting software.

*Literature*:

- Seidewitz, Ed and Stark, Mike: Reliable Object-Oriented Software, SIGS Books, 1995.
- Bosh, Jan: Design and Use of Software Architectures, Adopting and evolving a product-line approach, Addison-Wesley 2000.

**Artificial Intelligence**, 3 credits, A, DM, Timo Knuutila, University of Turku. Fall 2000.

*Contents*: Attempts to define artificial intelligence (AI) vary on two dimensions. One axis concerns thought processing or reasoning, the other addresses behavior. Success in both of these can be measured either against human performance or against an ideal concept of intelligence: rationality. We follow the approach presented by Russell where the goal of AI is to build up systems that act rationally: intelligent agents. Main topics covered on the course are problem solving, knowledge representation and planning.

*Components*: Lectures (52 h) and examination.

*Literature*:

- Nilsson, Nils J.: Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, 1998.
- Russell & Norvig: Artificial Intelligence: A Modern Approach, Prentice-Hall 1995.

**Automata and Formal Languages**, 5 credits, A, DM, Juhani Karhumäki, University of Turku. Spring 2000, fall 2001.

*Contents*: Automata theory constitutes a cornerstone of mathematical computer science, and in particular finite automata have turned out very useful tools in many areas of discrete mathematics. Different models of automata in classical Chomsky Hierarchy as well as corresponding grammars are considered and their generating power is compared. Basic undecidability results are proved.

*Components*: Lectures (56 h, Karhumäki), exercises (28 h), examination.

*Literature*:

- Hopcroft, J.E., Ullman, J.D.: Introduction to Automata Theory, Languages and Computation.

**Category Theory for Computer Science**, 3 credits, Reino Vainio, Åbo Akademi University. Department of Mathematics, Fall 2000.

*Contents*: Assuming a minimum of mathematical preparation, the course provides a presentation of the basic constructions and terminology of category theory, including limits, functors, natural transformations, adjoints, Galois connections, and cartesian closed categories. The last section of the prescribed book contains briefly expressed applications of category theory - a sketch of the connections between cartesian closed categories and lambda calculi, an

application to the design of programming languages, as well as applications to semantics and to the solution of recursive domain equations.

*Components*: Lectures (30h), exercises (10h), examination.

*Literature*:

- Benjamin Pierce: Basic Category Theory for Computer Scientists, The MIT Press, 1991 (or later printings).

**Code Optimization**, 3 credits, SE, Mats Aspnäs, Åbo Akademi University, Department of Computer Science. Spring 2001.

*Contents*: The course covers topics in code optimization, i.e. how to construct high performance computer programs that use the hardware resources of the processor in an efficient way. The goal of the course is to give an understanding of how program instructions are executed by a processor and how different high-level programming constructs affect the performance of a program.

*Litterature*:

- Kevin Dowd, Charles Severance, High Performance Computing, RISC Architectures, Optimization & Benchmarks. O'Reilly, 1998.
- John L. Hennessy, David A. Patterson, Computer Architecture, A Quantitative Approach. Morgan Kaufman Publishers, 1996.

**Coding and Encryption in Telecommunication**, 5 credits, Valery Ipatov. Fall 2001.

*Contents*: The main target of the course is to familiarize students with basic issues of telecommunication links design comprising information compression, channel error control and data security. Topics to be considered are: information measures and quantities, source models, efficient source coding, digital and continuous data compression (with speech, image and multimedia ompression illustration), fundamental channel coding theorems, block coding and classic code parameter bounds, linear codes, syndrome decoding, cyclic codes (with a concise insight into finite fields and polynomials), trellis (convolutional) codes and algorithm Viterbi, spectral-efficient transmission and trellis-coded modulation, data ciphering, public key cpyptosystems, authentification algorithms. All parts of the course are supported with examples of systems currently in operation or forward-looking (GSM, cdmaOne, 3G mobile radio, etc.).

*Components*: Examination and exercises.

*Literature*:

- R. B. Wells, Applied Coding and Information Theory for Engineers, Prentice Hall, 1999

**Combinatorics of Words**, 5 credits, DM, Juhani Karhumäki University of Turku, Department of Mathematics. Spring 2001.

*Contents*: A word is a finite or infinite sequence of symbols (from a finite set). In this course we consider simple, as well as more advanced, combinatorial problems of words. For example, when two words commute, or how long words exist without containing a repetition of a certain type (like a square). Also some more algebraic properties of words are considered, results have applications in many fields of discrete mathematics and theoretical computer science.

*Components*: Lectures (56 h Karhumäki), exercises (28 h), examination. Spring 2001.

*Literature*:

- Lecture notes
- M.Lothaire. Combinatorics on words, Addison-Wesley, 1983
- C. Choffrut and J. Karhumäki. Combinatorics of words, in Handbook of Formal Languages, Springer

**Competitive Analysis of Algorithms**, 3 credits, A, Tomi Pasanen, Universtity of Turku. Spring 2000.

*Contents*: In competitive analysis we compare an algorithm with the optimal algorithm by dividing a running time or an obtained result of the algorithm by that of the optimal algorithm. If the division ratio can be bounded by some constant c for all inputs, we say that the algorithm is c-competitive or c-approximative. This approach can be used to both online and offline algorithms.

*Components*: lectures 52 h, examination.

*Literature*:

- Borodin A., El-Yaniv R., Online Computation and Competitive Analysis, Cambridge University Press, 1998.
- Motwani R., Lectures Notes on Approximation Algorithms - Volume I, Department of Computer Science, Stanford University.

**Computer Graphics**, 5 credits, SE, Jan Westerholm, Åbo Akademi University, Department of Computer Science. Spring 2001.

*Contents*: The course gives an introduction to the hardware and software of computer graphics, and explains how to plan and implement interactive 2D and 3D graphical applications. Central themes will be modelling, outout device characteristics, geometrical transformations, illumination and colours, and algorithms in computer graphics.

*Components*: Lectures (56 h), exercises (28 h), examination.

*Literature*:

- Hearn & Baker: Computer Graphics (2nd ed.), Prentice Hall, 1997, C or Pascal version.
- Alternatively: Foley, van Dam, Hughes, Feiner & Philips: Introduction to Computer Graphics, Addison-Wesley, 1993.

**Computer Networks and Security**, 3 credits, A, ES, Antero Järvi, University of Turku, Department of Computer Science. Spring 2001.

*Contents*: A number of principles and practical issues dealing with network security will be covered. Issues to be discussed include the basics of encryption, authentication methods and digital signatures and access control. Also to be discussed are Email security, Internet security (IPSec), Web security and firewalls. The basic principles of Virtual Private Networking will be presented.

*Literature*:

- William Stallings: Cryptography and Network Security: Principles and Practice.

**Computer-Supported Work**, 3 or 5 credits, IS, E. Karsten, University of Turku. Fall 2000.

*Contents*: The aim of the course is to put information technology into the context of human (work) activity. Starting from the fundamental level of the work performed by one individual, the view is expanded to larger units, such as various kinds of groups, organisational units, and organisations. The role of information technology is analysed in several ways. We will look at IT, among others, as a tool, as a medium for communication and coordination, as an aid for organisational learning and remembering, as an object of work, and as an element in the organisational infrastructure.

*Components*: Lectures and exam 3 credits. Research study, report, and presentation 2 credits. (this part is optional).

**Corporate Information Technology**, 3/5 credits, IS, Christer Carlsson, Åbo Akademi University. Spring and fall 2000, spring 2001.

*Contents*: The course aims to show the role and impact of modern information technology on the management processes in the corporate world. The introduction of modern information

technology will form processes of change, with an impact on sustainable competitive advantages for a company. Central themes in the course will be virtual organisations, business process reengineering and management in a global networked organisation.

*Components*: Lectures, cases and a course paper.

*Literature*:

- McKeen, James D. & Heather A. Smith, Management Challenges in IS: Successful Strategies and Appropriate Action, John Wiley & Sons, 1996
- Hammer, Michael & Steven A. Stanton, The Reeingineering Revolution, Harper Business, 1995
- Hasselbein, Frances et al (eds), The Leader of the Future, New Visions, Strategies and Practices for the Next Era, Jossey-Bass Publishers, 1996
- Checkland, Peter & Sue Holwell, Information, Systems and Information Systems, John Wiley & Sons, Inc. 1998, 259 p.
- Articles

**Cryptography**, 5 credits, DM, Ari Renvall, University of Turku, Department of Mathematics. Spring 2001.

*Contents*: Cryptography is a new fascinating field of science. In particular, the idea of a public-key cryptosystem, introduced in 1976 by Diffie and Hellman, has changed our ideas of communicating possibilities drastically. In this course several examples of classical as well as modern (i.e. public-key) cryptosystems are considered and compared. Striking examples of using protocols in communication are discussed. Cryptography is connected to many areas of classical mathematics, such as number theory, complexity theory of algorithms, information theory etc. The most fundamental notion of modern cryptography is that of a one-way function, i.e. a function the value of which on a given input is easy to compute, but the inverse of it cannot be computed in practice - according to the current knowledge.

*Components*: Lectures (56 h), exercises (28 h), midterm exams, final exam.

*Literature*:

- Lecture Notes.
- Salomaa: Public-Key Cryptography, Springer (1996)

**Current Issues in IS Research,** IS, Eija Karsten, University of Turku, Department of Computer Science. Fall 2001.

*Contents*: Designing information systems for distributed organisations. The first part of the course will cover some theoretical underpinnings related to how people work with IT when they need to cooperate even though they do not work in the same place or have the same office hours. The issues covered include time, space, social shaping, trust, and interpersonal relationships. The lecturer is Dr J Nandhakumar, University of Bath. The second part of the course will cover central themes in relation to the integration of work practice and information systems design. Each theme is described through introductory texts, illustrated by recent empirical research (e.g. fieldwork materials and analyses) and discussed in the class. Furthermore, the students will have a chance to gain experience in the related skills through practical exercises. The lecturer is Dr H Karasti, University of Oulu. The third part, the project will give a possibility to encounter the issues met during the course in actual practice. The students will study real work situations with the help of video and co-construct requirements for information systems based on the study.

**Data Mining**, 3 credits, A, IS, Timo Knuutila, University of Turku. Spring 2000.

*Contents*: This course provides an introduction to the data mining methods that are frequently used in the process of knowledge discovery. We first elaborate on the fundamentals of each of the data mining methods: rough sets, Bayesian analysis, fuzzy sets, genetic algorithms, machine learning, neural networks, and preprocessing techniques. We then go on to

thoroughly discuss these methods in the setting of the overall process of knowledge discovery. Several illustrative examples and experimental findings are also presented.
*Components*: lectures (52 h)

**Design and Analysis of Computer Algorithms** 3 credits, Olli Nevalainen, University of Turku. Fall 2000.
*Contents*: The course concentrates on the design and analysis of efficient computer algorithms. The topics include design principles, complexity theory and approximation techniques.
*Components*: Self-study material (Olli Nevalainen), examination.
*Literature*:

- Cormen, T. H., Leiserson, C. E., Rivest, R. L.: Introduction To Algorithms, The MIT Press, 1989.
- Manber, U. Introduction to Algorithms, A Creative Approach, Addison-Wesley, 1989.

**Digital Economy**, 5 credits, IS, Reima Suomi and Virpi Tuunainen, Turku School of Economics and Business Administration. Fall 2000.
*Contents*: The course will introduce students to the classical economic theories that cast light on the new electronic commerce. Especially, the course will deliver needed theoretical background to those focusing on thesis work on electronic commerce. The course consists of lecturing and seminar work by the students in groups together with students from HKKK/ TuKKK.
The economic appoaches to be discussed include:

1. The transaction cost approach
2. Agency costs
3. Resource-based theories
4. Knowledge management
5. Organizational learning
6. Virtual organization

*Components*: 24 hours of contact teaching.
*Literature*: announced at the beginning of the course

**Electronic Business**, 2, 3 or 5 credits, IS, Reima Suomi, Turku School of Economics and Business Administration, Information Systems Science and Professor Stefan Klein, Universität Münster, Germany. Spring 2001.
*Contents*: The diffusion of global information and communication infrastructures and the convergence of IT, Telecommunications and Media (or content) industries Communication are driving the proliferation of Electronic Commerce (EC) or Electronic Business. Different from earlier innovations and IT trends, EC is more then an enabling technology: it is at the core of (new) businesses and it is thus redefining the role of Information Systems field. The course is divided into six parts: it starta with a framework for EC business models (1). It looks into the plethora of technologies behind EC which cover almost every aspect of the IS field (2). We try to understand what is behind the fast diffusion of EC (3) and look into strategic implications for companies and entire industries (4). Finally implementation aspects (5) and assessment models and tools for companies' Web activities (6) are discussed. The course covers a broad range of aspects from theoretical fundaments up to implementation and strategic issues. Current European examples from various industries, such as tourism, logistics, auto distribution, gaming and insurance, will be used as empirical evidence to illustrate the conceptual ideas.
*Components*: 16 hour of contact teaching
*Literature*:

- 1.Wigand, Rolf T.; Picot; Arnold; Reichwald, Ralf, Information, Organization and Management - Expanding Markets and Corporate Boundaries, Chichester: Wiley 1997.

- 2.Westland, Christopher; Clarke, Theodore, Global Electronic Commerce, MIT Press 1999.

**Electronic Commerce**, 5 credits, IS, Bill Anckar and Pirko Walden, Åbo Akademi University. Spring 2000, 2001.

*Contents*: The aim is to give the students advanced level knowledge in electronic commerce. The course is designed to help students understand how Internet-caused marketplace changes unfold, and provides them with the skills to turn them into an important source of competitive advantage. It bridges the gap between current management problems and technology available to solve them. As an essential part of the course we concentrate on analysing and planning Internet projects, creating implementable solutions for the project companies (SMEs).

The contents can be divided in:

1. Rethinking the business strategies
2. International virtual projects
3. Field work in small and medium sized companies

*Components*: Lectures (guest lectures after office hours), exercises, and course assignments (with oral presentations).

*Examination*: Working papers and course assignments. Active class participation with material prepared for every lecture.

*Literature*:

- Hagel III, John and Marc Singer: Net Worth, HBS Press 1999.
- To be announced later (new literature from 1999-2000)
- Articles

**Embedded Systems Design**, 3 credits, ES, Johan Lilius, Åbo Akademi University. Fall 2000.

*Contents*: The course introduces the student to modern design methods for embedded systems. Topics covered include:

- Basic concepts of real-time and safety-critical systems
- Behavioral analysis using hierarchical statemachines
- Architectural and mechanictic design of embedded system

**Embedded Systems Laboratory Course**, 3 credits, ES, Johan Lilius, Robert Gyllenberg, Guest Lecturers, Åbo Akademi University. Spring 2000, 2001.

*Contents*:

- industrial seminar sessions
- laboratory exercises
- project: The students will implement a working piece of embedded hardware and software as individual or team work.

*Examination*: There will be no final exam at the end of the course. However, to pass the course: Attend every seminar. Keep a short diary of the contents and turn it in after the last seminar. Attend the demonstrations and do the laboratory work properly. Choose an interesting project of your own or ask for a suggestion. Commit yourself to the project. Make your project work and demonstrate the real thing together with its documentation.

*Literature*: Data sheets, manuals and other material will be distributed during the course.

**Evaluation of Information Systems**, 5 credits, IS, Jarmo Tähkäpää, Turku School of Economics and Business Administration, Information Systems Science. Spring 2001.

*Contents*: This course focuses on issues in information systems evaluation. The course gives an economical view to the evaluation, as well as view, how to evaluate the usability of information systems. Topics like decisionmaking, costs, benefits, usability, different perspectives in evaluation (e.g management, users) and evaluation methods are discussed in this course.

The aim is to learn different ways and perspectives to evaluate information systems and their utilisation and to use these methods in practise. The course consists of seminar works and lectures.

*Components*: Lecture/seminar course 24 h "Evaluation of Information Systems"

*Literature*:

- A collection of articles
- Literature announced later

**Functional Programming**, 5 credits, Aimo Törn, Åbo Akademi University. Fall 2000.

*Contents*: The main topics of the course are: FP principles with Scheme, and prototyping with me too. We will also to some extent describe SML. Scheme is a dialect of Lisp (List Programming) an untyped prefix notational language developed in the late 50s at MIT by John McCarty, SML (late 80s) is a typed infix notational language, and me too takes the form of an executable formal specfication language for describing and prototyping system designs at the early stage of development. The student will learn and understand principles of functional programming and will be able to solve problems by using these.

*Components*: Lectures, Exercises, Course Paper, Examination.

*Literature*:

- Abelson, H and G.J. Sussman with J. Sussman: "Stucture and Interpretation of Computer Programs", MIT Press, Cambridge, Mass., 1985.
- Alexander, H. and V. Jones: Software Design and Prototyping Using me too, Prentice Hall, New York, 1990.
- Huges, J.: "Why Functional Programming Matters", Computer Journal 32,2, 1989, pp. 98-107.
- Myers, C., C. Clack and E. Poon: Programming with Standard ML, Prentice Hall, New York, 1993.
- Springer, G. and D.P. Friedman: Scheme and the Art of Programming, MIT Press, London, 1989.
- "About Haskell", http://www.haskell.org/aboutHaskell.html

**Hardware/Software Codesign**, 3 credits, ES, Seppo Virtanen and Johan Lilius, Åbo Akademi University, Department of Computer Science. Spring 2001.

*Contents*: Traditional embedded system design views the design of software parts of the system as a separate task from the design of hardware parts. The purpose of hardware/software codesign is to provide an integrated way for designing hardware and software. The design work starts from a system description that is not biased towards either hardware or software. This system description is then refined into software and hardware components. Typically the refinement step is done automatically by synthesising assembler and VHDL from the system description. The decision about which parts go into into hardware and which into software (a process called partitioning) is done by estimating the performance of the system on the system model level. The advantage of this is that it makes it possible to fully explore the design space and find an optimal solution to the design problem. The aim of this course is to introduce the student to fundamental issues in hardware/software codesign:

- Basic issues in system design, and various conceptual models that can be used to capture system behavior.
- Algorithms and techniques for system partitioning and estimation
- Algorithms and techniques for synthesis of software and hardware

*Components*: Lectures 28 h, homework assignments. The lectures are mostly seminar presentations given by students. To pass the course, students have to give several seminar presentations and obtain at least 50% of the points available in the homework assignments. There will be no exam.

*Literature*:

- Daniel D. Gajski, Frank Vahid, Sanjiv Narayan, and Jie Gong. Specification and Design of Embedded Systems. Prentice Hall, 1994.

**High Performance Computing**, 3 credits, SE, A, Mats Aspnäs, Åbo Akademi University. Fall 2000.

*Contents*: The course gives an introduction to High Performance Computing. The main emphasis of the course is on techniques and tools for efficiently solving large and computationally intense problems on parallel computers. The course covers the following topics:

- High performance computer systems
- Parallel programming using MPI
- Efficiency and code optimization

*Components*: Lectures 28 h, excercises 8 h, course assignment.

*Literature*:

- Ian Foster, Designing and Building Parallel Programs, Concepts and Tools for Parallel Software Engineering, Addison-Welsey, 1995.

**Human Computer Interaction**, 5 credits, IS, John Darzentas. Fall 2000, spring 2001.

*Contents*: Human Computer Interaction (HCI) is now recognized as a vital component of successful computer applications. The main aim of the course is to expose students to HCI within the information systems design and creation context to enable, to develop and/or actively utilise user centred systems. HCI is a genuinely interdisciplinary subject and as a result, HCI courses can be designed to emphasise various areas of concern and interest. The general objectives of the present course are threefold:

- to give a general introduction to the subject of HCI;
- to able those with a background in information systems/computer science to usefully incorporate HCI requirements when designing and developing information systems;
- to aid those creative users of information systems to understand, require and optimise 'usability' in the systems they introduce in their organisations.

*Components*: Lectures, course assignements. The course assignments take the form of a common exemple to be analysed by students using each time a different HCI approach. Students are required to submit a written report electroni-cally during the spring semester. This is based on classwork presented by students in the second week of the course.

*Literature*:

- Finlay A.J. et al, Human Computer Interaction, Prentice Hall, 1993
- Preece, J. et al, Human Computer Interaction, Addison Wesley, 1994.

**Industrial Algorithms**, 3 credits, ES, SE, Risto Lahdelma, University of Turku, Department of Computer Science. Spring 2001.

*Contents*: Algorithms commonly used in various industrial applications. Topic may change annually. Linear and mixed integer programming, network programming, estimation, basic control theory, statistical process control, special algorithms. Applications in pulp and paper industry, metal industry, electronics, energy, medical technology.

**Introduction to Semigroups**, 3 credits, DM, Göran Högnäs, Åbo Akademi University, Department of Mathematics

*Contents*: The course provides a presentation of the basic notions and examples of elementary algebraic semigroup theory. Green's relations, completely simple semigroups and the Rees-Suschkewitsch decomposition will be treated. The main examples are drawn from transformation semigroups and semigroups of relations on a given set.

*Components*: Lectures (30h), exercises (15h), examination.

*Literature*:

- Högnäs and Mukherjea: Probability Measures on Semigroups, Plenum Press, New York 1995, in particular, Chapter 1.

**Intelligent Systems in Business** 5 credits, IS, Barbro Back, Åbo Akademi University,

The course aims at deepening the participants' knowledge in modern computer supported problem solving. We look at the state of the art in advanced knowledge based systems, at new technological developments and emerging paradigms in intelligent systems.

*Contents*:

1. Knowledge Based Systems
2. Fuzzy logic, agent technology
3. Intelligent Support Systems
4. Future System technology

*Components*: Lectures, cases, working papers, written examination.

*Literature*:

- 1.Dhar, Varsant & Roger Stein, Intelligent Decision Support Systems, Prentice-Hall 1997, 244 p.
- Articles on fuzzy sets och fuzzy logic, neural nets and intelligent agents according to instructions.

**Introduction to Program Refinement**, 5 credits, SE, Joakim von Wright, Åbo Akademi University

*Contents*: The Refinement Calculus is a calculus for rigourous program construction by stepwise refinement. Stepwise refinement is a paradigm for problem solving, where a problem formulation is gradually transformed into a solution of the problem. In program refinement, an initial specification is tranformed step by step into an implementable program using transformations that introduce data structures and control structures. The aim of this course is to make the participants familiar with the Refinement Calculus, its foundations and its applications. Major topics covered in the course are the following:

- foundations for reasoning about imperative programs
- program statements and their building blocks
- transforming specifications into programs
- ecursion and procedures
- examples and case studies

*Literature*:

- R.J. Back and J. von Wright, Refinement Calculus - A Systematic Introduction, Springer, 1998.

**Knowledge Sharing in High Technology Environments**, 3-4 credits, IS, Inger Eriksson, University of Turku, Eija Karsten, University of Jyväskylä. Spring 2000.

*Contents*: The aim of the course is to investigate how knowledge can be effectively shared and created in organizations in the fast-moving high technology environment of the 21st century. The course orientation is one that joins information technology perspectives with management perspectives in an integrated fashion.

*Components*: Interactive lectures (32 h, Inger Eriksson), group discussions, and presentations.

*Literature*:

- Davenport & Prusak: Working knowledge. 1998.
- Journal articles and research papers.

**Knowledge Sharing in High Technology Environments**, 3 credits, IS, Inger Eriksson and Adekunle Okunoye, North Carolina State University. Fall 2001.

*Contents*: Knowledge management is aimed at investigating how knowledge can be effectively managed in organizations in the fast moving high technology environment of the 21st century. The course orientation is one that joins information technology and management perspectives in an integrated fashion. Knowledge management addresses the generation, representation, storage, transfer, transformation, application, and protection of knowledge within organizations. The course will also deal with establishing an organizational environment and culture in which knowledge can evolve. One further aim is to give the students an insight in the technological aspects of knowledge management, and an appreciation of software tools used in managing knowledge. The course grade is based on active participation including commenting the American students' assignments, individual and group assignments, term papers and presentations, and the examinations.

*Literature*:

- Davenport and Prusak: "Working Knowledge - How Organizations Manage What They Know", Harvard Business School Press, 1998 (or later) -available e.g. in Amazon
- Reading package - see course assistant Adekunle Okunoye (AO) at Turku University (UTU), DataCity
- Articles to be distributed during the course

**Linking IT and Business Strategy**, 5 credits, IS, Tawfik Jelassi, Åbo Akademi University and Kalle Kangas, Turku School of Economics and Business Administration. Fall 2000.

*Contents*: The objective is to provide the students with a theoretical knowledge of the research on strategic information systems planning (SISP). The course is based on a review of various theories of the firm and the implications of these theories on 1) development methods, 2) strategic influence of an enterprise's information systems. During the course following issues are discussed: Information systems development and evaluation methods based on value-chain analysis, resource-based view and transaction cost analysis; competitive and organizational implications of technology; virtual and network organizations; as well as knowledge management and organizational learning within an enterprise.

*Components*: Lecture course "Linking IT and Business strategy" 12 h. Seminars and group work sessions 12 h.The working methods for the course consist of lectures, seminar sessions and group work. The teachers are Kalle Kangas for lectures and literature, and Tawfik Jelassi for cases and groupwork.

*Literature*:

- Applegate, L., - Mcfarlan, W. - Mckenney, J., Corporate Information Systems Management: Text and cases, 5th ed., Chicago: Irwin, 1999.
- Barney, J. B., Gaining and Sustaining Competitive Advantage, Reading, Ma: Addison-Wesley, 1997 (parts chosen by the lecturer).

**Linking IT and Business Strategy**, IS, Christer Carlsson and Tawfik Jelassi, Åbo Akademi University, Department of Information Systems. Fall 2001.

*Contents:* Underlying every function in a business, whether it is an industrial or a service organization, is information technology (IT). This technology serves as an essential enabler for creating and implementing business strategies suited for the 21st century corporation. It allows companies to go beyond efficiency and effectiveness improvement and create business opportunities in the new world of the networked corporation and the information society. Moreover, IT is drastically impacting management and business processes, changing the competitive balance between companies, and increasingly blurring the boundaries of several industries. This course focuses on how IT can create or transform the business strategy of a firm.It discusses the impact of Internet and wireless commerce as a new locus of value creation.

1. The use of IT to leverage corporate strategy into competitive advantage
2. Strategic information systems
3. The networked organization and virtual teamwork
4. Effective customer response and supply chain management
5. IT as an enabler of e-business
6. Strategic management and IT

*Literature*:

- Applegate, L., W McFarlan & J. McKenney, Corporate Information Systems Management: Text and cases, 5th ed., Chicago: Irwin, 1999
- Eden, C. & F. Ackerman, Making Strategy, Sage, London 1998
- Lucas, H.C., Information Technology and the Productivity Paradox, Oxford University Press, New York 1999
- Articles, selected cases and chapters of books

**Linux and System Programming**, 3 credits, ES, R. Lahdelma, University of Turku. Fall 2000, 2001.

*Contents*: The course introduces C/C++ and standard UNIX interface eg. the file system, process management, interprocess communication and network programming. During the course students will become familiar with structure of LINUX kernel and developing device drivers. The aim is to understand different layers of operating system and their implementations. The course provides with practical skills for developing UNIX applications and LINUX device drivers.

*Components*: Lectures, project work and examination.

*Literature*:

- Beginning Linux Programming , Neil Matthew & Richard Stones, 1996 WROX Press.
- Linux Device Drivers , Alessandro Rubini, 1998 O'Reilly.

**Local Networks**, 3 credits, SE, Aulis Pirinen, Åbo Akademi University. Fall 2000.

*Contents*: The course points to give a profound and up-to-date knowledge of local networks (LANs), mainly dealing with their building blocks and structures, implementations, functional principles and used protocols. Accessibility, integrated services and interworking with other networks are also discussed. Typical local networks being dealt with are Ethernet, Fast Ethernet, Token ring and FDDI. Because of relatedness to LANs, MAN systems form an natural part in our considerations. The role of Internet- and isdn-based concepts (e.g. TCP/IP and ATM) in connection with or within LANs, as fibres and wirelessness, managing, performance and design questions among LANs, belong also to the course.

*Components*: Lectures 32 h, course assignments 8 h, and a larger well-reported project work. Examination. The course can also be passed if all small assignments of four given weeks and the project work are performed with good (3/5) or better marks. In this case no exams are needed. The students are waited to propose their own project works.

*Literature*:

- W. Stallings: Local and Metropolitan Area Networks, 6th Edition (Prentice Hall 2000)
- K. Saarelainen: Lokala Nät (Studentlitteratur 1996)
- G. E. Keiser: Local Area Networks (McGraw-Hill 1989)
- Furthermore other books and articles are used. Detailed information is given during the course.

**Logic Programming**, 3 credits, SE, A, DM, Timo Knuutila, University of Turku. Fall 2001.

*Contents*: Logic programming is, like functional programming, a declarative way of composing programs. In brief, declarative programming is much more concerned on what should be computed and much less with how it should be done. A logic programming language is a

formalism for expressing ones ideas in the form of some chosen logic. The execution of the program consists then of proving (or disproving) that some logical consequence follows from those expressions. There are, however, different logics, different ways of proving theorems in those logics, and different ways to implement a certain mechanized form of reasoning by traditional computer. The most well-known logic programming language, Prolog, is based on (a restricted case of) predicate logic, a theorem proving algorithm called SLD-resolution, and an (approximative) implementation based on simple depth-first search. In addition to this rather traditional view to logic programming, we also discuss other languages (based on other logics and/or theorem proving algorithms) that are more general and/or more declarative than Prolog. The pragmatics of logic programming are also considered: the basic programming techniques and data structures of logic programming are quite different from the traditional ones. Last, we present some application areas for which logic programming is often the most natural formalization tool.

*Components*: Lectures (52 h) and examination.
*Literature*:

- U. Nilsson, J. Maluszynski: Logic, Programming and Prolog, John Wiley & Sons, 1995 (2nd ed.).

**Management of IS Projects**, 5 credits, IS, Hannu Salmela, Turku School of Economics and Business Administration. Spring 2000, 2001, fall 2001.

*Contents*: This course covers issues related to the management of large and global IS projects in general, and enterprise resource planning (ERP) implementation projects in particular. The lectures illustrate alternative ways how large multinational companies integrate their information systems and infrastructures. Also the efforts needed to unify information management and to develop new business practices and structures across different business units will be discussed. Emphasis is also placed on the structural changes that often accompany ERP implementation. Guest lecturers (or company visits) will be used to illustrate both the company perspective and the vendor/consultant perspective to managing large IS projects. Also some of the traditional project management techniques will be reviewed. Students will also be asked to write and present a review report of some topic related to ERP and its implementation. Taking a systems development course before attending to this course is recommended.

*Components*: Lecture/seminar course "Management of large IT projects" 24 h. Exams: TJT2, Management of Large IT projects, Lectures and literature, 5 sv.

*Literature*:

- Sergio Lozinsky, Enterprise-Wide Software Solutions, Integration Strategies and Practices, Addison Wesley, 1998.
- Miikka Jahnukainen and Ari Vepsäläinen (Eds.) Process Management Works - If only Implemented, 1998.

**Mathematical Epidemiology of Infectious Diseases**, 5 credits, MM, Mats Gyllenberg, University of Turku, Department of Mathematics. Spring 2001.

*Contents*: This course presents the basic principles of modelling the spread of infectious diseases, as well as mathematical tools for analysing the resulting models. Special attention will be paid to threshold phenomena related to the outbreak of an epidemic, modelling of contacts between individuals, models including age structure (both age of individuals and age of infection), and spatial stucture. It is hoped that the students will learn how to translate assumptions into mathematics, and how to draw conclusions when results from mathematical analysis is translated back into biology. The course is therefore recommended to everyone interested in mathematical modelling, not only to those interesting in mathematical epidemiology per se.

*Components*: Lectures (56 h), exercises (28 h), examination.
*Literature*:

- Diekmann, Heesterbeek: Mathematical Epidemiology of Infectious Diseases. Model Building, Analysis and Interpretation, Wiley, 2000.

**Model Checking**, 3 credits, ES, Johan Lilius, Åbo Akademi University. Spring 2000.
*Components*: The course will be organised in two parts: a reading course and a project. There will be no lectures or exam. The grade will be based on the quality of your project. The reading course is meant to give you the basic information to tackle the project.

**Mechanical Verification,** 5 credits, Linas Laibinis, Åbo Akademi University, Department of Computer Science. Fall 2001.
*Contents*: In mechanical verification, logic-based computer tools (mechanised logics) are used for specifying objects and reasoning about their relationships and properties. The objects involved can be of many different kinds, ranging from simple hardware devices to complex software systems. One of the most successful systems used in mechanical verification is the HOL system, developed at Cambridge University. In this course, we use the HOL system for logical modelling and mechanical verification. The objects studied include hardware components, algebraic structures, data types and computer programs (depending on the interests of the participants).

**Multimedia Databases** 3 credits, SE, A, IS, Jukka Teuhola, University of Turku, Department of Computer Science. Fall 2001.
*Contents*: The course studies the storage and retrieval of different types of data used in multimedia applications, including text, image, video and audio data. For text, different kinds of indexing and content-based retrieval techniques are discussed. As for images, we study the representation and processing of digitized images, as well as spatial data structures for geometric applications (engineering drawings, maps, etc.). Standard techniques for organizing and representing video and audio data are discussed. The storage of multimedia data on physical media (tape, disk, CD-ROM) are briefly explained. Finally, some issues related to constructing distributed multimedia databases in a network are considered.
*Components*: lectures (52 h, Jukka Teuhola), examination.
*Literature*:

- V.S. Subrahmanian: Principles of Multimedia Database Systems, Morgan Kaufmann 1998.
- S. Khoshafian, A.B. Baker: Multimedia and Imaging Databases, Morgan Kaufmann, 1996.

**Neural Networks**, 4-5 credits, A, IS, Timo Järvi, University of Turku. Spring 2000.
*Contents*: The aim of this course is to give a solid and practical introduction to neural networks - computational models inspired by the brain. The basic concepts and technology underlying such models will be explained. Then it will be shown how these models can be applied to the solution of diverse problems in science and engineering.
*Components*: lectures (56 h), 14 exercises, examination (= 4 credits) and course assignment (= 1 credit).
*Literature*:

- J. Hertz, A. Krogh, R.G. Palmer: Introduction to the theory of neural computation, Addison-Wesley, 1991.
- R. Hecht-Nielsen, Neurocomputing, Addison-Wesley 1990.
- J.A. Freeman, D.M. Skapura: Neural Networks: Algorithms, Applications, and Programming Techniques, Addison-Wesley 1991.

**Parallel Computing**, 3 credits, Mats Aspnäs, Åbo Akademi University. Spring 2000.

*Contents*: The course presents a number of problems in scientific computing and shows how to develop and implement efficient solutions to these using parallel computing. After the course, the students will be familiar with different methods for decomposing large computational problems so that they can be solved with parallel processing and familiar with tools for implementing efficient parallel programs. The course covers the following topics:

- Parallel programming with the Message Passing Interface
- Solving scientific problems with parallel computing
- Performance optimisation of parallel programs

*Components*: Lectures 28 h, excercises 8 h, course assignment

*Literature*:

- Barry Wilkinson and Michael Allen, Parallel Programming, Techniques and Applications Using Networked Workstations and Parallel Computers, Prentice-Hall, 1999.
- Peter Pacheco, Parallel Programming with MPI. Morgan Kaufmann, 1997.

**Probabilistic Algorithms**, 5 credits, A, SE, Aimo Törn, Åbo Akademi University, Department of Computer Science. Spring 2001.

*Contents*: A probabilistic algorithm is an algorithm where the result and/or the way the result is obtained depend on chance. These algorithms are also sometimes called randomized algorithms. In some applications the use of probabilistic algorithms is natural, e.g. simulating the behaviour of some existing or planned system over time. In this case the result by nature is stochastic. In some cases the problem to be solved is deterministic but can be be transformed into a stochastic one and solved by applying a probabilistic algorithm (eg. numerical integration, optimization). For these numerical applications the result obtained is always approximate, but its expected precision improves as the time available to use the algorithm increases. The techniques of applying probabilistic algorithms to numerical problems were originally called Monte Carlo methods. There are also a number of discrete problems for which only an exact result is acceptable (eg. sorting and searching) and where the introduction of randomness influences only on the ease and efficiency in finding the solution. For some problems where trivial exhaustive search is not feasible probabilistic algorithms can be applied giving a result that is correct with some probability just less than one (eg. primality testing, string equality testing). The probability of failure can be made arbitrary small by repeated applications of the algorithm. One incentive for using probabilistic algorithms is that their application does not normally require sophisticated mathematical knowledge. Further, the programming is often rather trivial which means that an acceptable approximation can be obtained quickly. One can say that the use of probabilistic algorithms sometimes allow that theoretical knowledge and analytical work is compensated for by making extensive simple machine computations. In some other cases the probabilistic algorithms are the simplest and even the most efficient aivailable. Topics to be covered include: pseudo and quasi random numbers, calculation of integrals, optimization, simulation, and probabilistic algorithms for discrete problems.

*Literature*:

- Brassard, G. and P. Bratley: Algorithmics - Theory and Practice, Prentice-Hall, 1988. (Chapter 8)
- Harel, D.: Algorithmics - The Spirit of Computing, 2nd Edition, Addison-Wesley, 1992. (Chapter 11)
- Knuth, D.E.: The Art of Computer Programming, Vol 2 Seminumerical Algorithms, Addison-Wesley, 1969. (Chapter 3)
- Motwani, R. and P. Raghavan: Randomized Algorithms, Cambridge University Press, New York, 1995.

- Törn, A.: Simulation Modelling, Reports on CS and Math., Ser. B, No 12, Åbo Akademi University, 1991.
- Törn, A. and A. Zilinskas: Global Optimization, Lecture Notes in Computer Science 350, 1978.
- Scientific Articles

**Software Architecture**, 3-5 credits, ES, SE, Kaisa Sere, Åbo Akademi University. Spring 2000.

*Contents*: This advanced level course aims at teaching you how to design, understand, and evaluate systems at an architectural level of abstraction. After the course you should be able to recognise different architectural styles, describe an architecture accurately, and generate and evaluate architerural alternatives. The course is suitable for computer engineering students in the embedded systems and software engineering programs as well as for computer science students. It can also be taken as a post graduate course.

*Components*: The course consists of 32 h lectures and 10 h exercises (3 credits). Additionally a seminar of 20 h (2 credits) will be organised provided there is enough interest. The following guest lecturers will participate in the course: Jan Bosch (Univ. of Karlskrona, Sweden), Juha Kuusela (Nokia Research Centre), Eila Niemela (VTT Embedded Systems) and Johan Wikman (Nokia Research Centre)

*Literature*:

- M. Shaw and D. Garlan, Software Architecture, Prentice Hall, 1996
- L. Bass, P. Clements, and R. Kazman, Software Architecture in Practice, Addison-Wesley, 1998,
- E. Gamma, R. Helm, R. Johnson, and J. Vlissides, Design Patterns, Addisson-Wesley, 1995
- a number of journal articles.

**Software Quality**, 5 credits, SE, S, IS, Aimo Törn, Åbo Akademi University. Spring 2000.

*Contents*: In software engineering software quality has become a topic of major concern. As software is becoming critically important for an organization to be competitive in its business, the requirement that the software is highly supportive for the organization in achieving its goals means that the software should have high utility and user quality. It has also been recognized that software maintenance is becoming the main activity in software work. With the growing collection of software in organizations this cost is becoming substantial. The amount of maintenance needed and the effort needed to perform a certain maintenance task is critically dependent on the technical quality of software resulting from the software development process. The student will learn and understand what quality means, how it can be measured, and how a measurement program can be implemented.

*Components*: Exercises, Course Paper, Examination.The excercises are obligatory and should be turned in in written according to announced schedule. Examination will be in form of two quizzes. The examination further includes an accepted assignment.

*Literature*:

- Eriksson, I. and A.A. Törn (1991), "A model for IS quality", Software Engineering Journal 6, 152-158.
- Fenton N.E. and S.L. Pfleeger: "Software Metrics - A Rigorous & Practical Approach", International Thomson Computer Press, London 1997 (Second edition).
- Törn, A.: Models of software accumulation, J. Systems Software, 1990; 12: 39-42
- Törn, A., T. Andersson and K. Enholm (1996), "An Effort-Length-Complexity Metrics Model for Software", TUCS Technical Report No. 99, 16 pp.

**Software Safety**, 5 credits, ES, SE, Kaisa Sere and Elena Troubitsyna, Åbo Akademi University, Department of Computer Science. Spring 2001.

*Contents*: The rapid development of computer-based technology has led to the wide-spread use of computers in control of safety-critical systems, i.e., systems whose failures might cause the loss of human lives, a devastating environmental catastrophe or significant economical losses. Examples of such systems include aircraft operating systems, nuclear power plants control systems, telecommunications and banking systems etc. While developing controlling software for such applications we need to consider software as a part of the whole system rather than in isolation. In the course we consider techniques used in safety and reliability analysis and their impact on software development. Moreover, we study how to comply the development process with the current standards. While conducting case studies we exercise the techniques and approaches recommended by the standards.

*Literature*:

- Neil Storey, Safety Critical Computer Systems, Addison-Wesley, 1996.
- Nancy Leveson, Safeware: System Safety and Computers, Addison-Wesley, 1996.
- Debra S. Herrmann. Software Safety and Reliability, IEEE Computer Society, 1999.

**Strategic Management of Information Resources**, 5 credits, IS, Kalle Kangas, Turku School of Economics and Business Administration. Spring 2000.

*Contents*: The course is aimed mainly for students majoring in information systems, as well as for students majoring in management and organization. The objective is to give the students a background for selecting the theoretical approach for their master's thesis (pro gradu). The course is based on a review of various theories of the firm and the implications of these theories on 1) development methods, 2) strategic influence of an enterprise's information systems. During the course following issues are discussed: Information systems development and evaluation methods based on value-chain analysis, resource-based view and transaction cost analysis; competitive and organizational implications of information technology; virtual and network organizations; as well as knowledge management and organizational learning within an enterprise. The working methods for the course consist of lectures, seminar sessions and group work.

*Components*: Lecture/seminar course " Strategic Management of Information Resources" 24 h.

*Literature*:

- Applegate, L., - Mcfarlan, W. - Mckenney, J., Corporate Information Systems Management: The Issues Facing Senior Executives, 4th ed., Chicago: Irwin, 1996.
- Barney, J. B., Gaining and Sustaining Competitive Advantage, Reading, Ma: Addison-Wesley, 1997 (parts chosen by the lecturer)
- A collection of articles chosen by the lecturer

**String Algorithms**, 3 credits, A, Timo Raita, University of Turku. Spring 2000.

*Contents*: String algorithmics is an extensive research field. Its basis lies in mathematics (automata and formal languages, combinatorics, information theory) and it has an extensive number of applications ranging from signal processing to spell checking and manipulation of biosequences. This course concentrates on the most important topics, such as substring search, longest common subsequences and suffix trees. Each topic is complemented with a discussion of various applications.

*Components*: lectures (52 h), examination.

*Literature*:

- Crochemore, M. & Rytter, W.: Text Algorithms, Oxford University Press, 1994.
- Stephen, G: String Searching Algorithms, World Scientific, 1994.
- Gusfield, D.: Algorithms on Strings, Trees and Sequences, Cambridge University Press, 1997.

**Telecommunications Protocols**, 5 credits, SE, Aulis Pirinen, Åbo Akademi University. Spring 2000, 2001.

*Contents*: The course aims to give a thorough and extensive knowledge of telecommunications protocols, mainly dealing with their building blocks and structures used nowadays widely in designing and in realized data and telecommunication networks. Especially protocol stacks, functioning principles and common mechnisms, features and challenges in service providing are discussed. Most protocols being considered serves in transmission, signalling, switching, transport and OAM actions. The study is based on OSI- and Z-architectures, and on several wide-spread telecommunication softwares as those used in Ethernet, Frame Relay, Internet, ISDN, B-ISDN, GSM. Protocol environments, production and testing are also treated.

*Components*: Lectures 36 h, course assignments 9 h, and a large well-reported project work (in groups or individually). There will be no examinations. The course will be passed and its grade will be determined on the basis of two small assignments and the project work. The students are waited to propose their own project works.

*Literature*:

- F.Halsall: Data Communications, Computer Networks and Open Systems, 4th Edition (Addison-Wesley 1996)
- A.S.Tannenbaum: Computer Networks, 3rd Edition (Prentice Hall 1996).
- several other books (or parts of them) and articles are used. Detailed information is given during the course.

**Telecommuncation Software**, 3 credits, SE, Aulis Pirinen, Åbo Akademi University, Risto Lahdelma, University of Turku, and Guest Lecturers from industry. Fall 2000.

*Contents*: In writing telecommunication software, there are a number of technics and a vocabulary that are often unfamiliar even to the students having a background in software engineering. The main purpose of the course is to teach the basic techniques in telecommunication software, reinforced by a sound set of applications. The course is well-suited to students who have Software Engineering, Embedded Systems or Telecommunication (in software) as their specialization studies. The course belongs to the new courses within TUCS that will be run in close cooperation with industry. So, for getting a true and deeper understanding of the use of SDL, a good part of lectures is delivered by specialists from different companies. However, the teaching of the basics in SDL and the supervising of the course are arranged by TUCS professors.

*Components*: Lectures and exercises 36 h. Lectures, including exercise hours, are divided into two parts.

- Part I (12 h) constitutes basic studies necessary for the course, and
- Part II (24 h) lectures given by specialists from industry.

Exercises are made up of several (3 or 4) smaller assignments and a larger well-reported project work. Examination. Alternatively, the course can be taken also by performing all assignments and the project work with good (3/5) marks or better. The students are waited to propose their own project works.

*Literature*:

- J.Ellsberger, D.Hogrefe, and A.Sarma: SDL, Formal Object-Oriented Language for Communicating Systems. Prentice Hall 1997. ISBN 0-13-621384-7.
- Course material, especially for Part II.

**Term Rewriting**, 5 credits, Magnus Steinby, University of Turku, Department of Mathematics. Fall 2001.

*Components*: 54 h lectures, 26 h exercises

**Theoretical Foundations of Iss**, 3 or 5 credits, IS, Markku Nurminen, University of Turku, Department of Computer Science. Fall 2001.

*Contents*: In the near future it will be increasingly important to understand different views on information systems when new development methodologies emerge and the domain of impacts is growing. The underlying assumptions and frameworks behind informations systems and their development are analysed. Different frameworks have different conceptualisations about the domain to be taken into account in the introduction of information technology, starting from a narrow technical definition to broader ones including language, work, social structures and business processes. A review on most important reference disciplines is provided.

**Topics in Logic**, 5 credits, Magnus Steinby, University of Turku. Fall 2000.

*Contents*: We shall consider some topics in mathematical logic usually not covered by general introductory courses although they are both of great intrinsic interest and have many applications. A tentative list of contents: tableaux, resolution; decidability questions; intuitionistic logic; modal logic.

*Components*: Lectures (54 h, Steinby), exercises (26 h), examination.

*Literature*:

- Lecture notes. The material is drawn from several sources, but especially the book "Logic for applications" by A. Nerode and R.A. Shone is used.

**Usability in Context**, 3 credits, IS, Markku Nurminen, University of Turku. Spring and fall 2000.

*Contents*: The aim of the course is to give the participants a holistic picture of the evaluation of the deployment of information systems in use. When the use situation of an IS is evaluated in a 'field setting', i.e. in an organisation, only very few variables can be controlled to the extent which is close to laboratory experiments. Therefore, the range of potential deployment problems increases substantially and we must use other means to evaluate the effectiveness/efficiency/value/etc of the IS. This course gives background knowledge and basic readiness for performing evaluation of implemented information systems.

*Components*: Lectures (42 h), examination, excercises

**Web Information Systems in Business Environment**, 5 credits, IS, Jussi Puhakainen, Turku School of Economics and Business Administration. Fall 2000.

*Contents*: The course focuses on the possibilities of web information systems (WIS) and related concepts in doing business. The aim is to investigate the new business opportunities and threats Internet is introducing, and the required changes to current business architecture and processes. Topics included: Internet-based electronic commerce (to consumers and businesses), intra-company solutions, marketing and customer service in Internet. Three important design-related questions are presented: Why, to Whom and What added value to target groups. The course includes a seminar work (2 sv) in which students (in groups of 4 or less) write an extensive report for real-life case-company on subjects related to the course. Students are free to find their own case companies or they will be provided with one (real-life or imaginary). Due to the nature of the course and seminar, students should have prior knowledge of Internet-technologies and marketing.

*Components*: Lectures and literature 3 credits and Seminar 2 credits.

*Literature*:

- Schwartz, Evan, Digital Darwinism: 7 breakthrough business strategies for surviving in the cutthroat web economy, New York: Broadway Books 1999.
- A collection of the articles.

## 7.2 Short Courses and Seminars

**Algorithms in Bioinformatics**, 2 credits, Tomi Pasanen, University of Turku. Fall 2000.

*Contents*: Combinatorial problems arising in the area of DNA and protein sequences are considered.

*Components*: Lectures (24 h, Tomi Pasanen), examination.

*Literature*:

- Waterman M.S., Introduction to computational biology, Chapman & Hall ,1995.
- Gusfield D., Algorithms on strings, trees, and sequences, Cambridge University Press, 1997.
- Durbin R., Eddy S., Krogh A., Mitchison G., Biological sequence analysis, Cambridge University Press, 1998.

**Bluetooth and Ad Hoc Networks**, J. Westerholm, 1-2 credits. Spring 2001.

**Fuzzy Logic and Fuzzy Numbers**, 2 credits, A, IS, MM, Robert Fuller, Eötvös Lorand University, Budapest. Fall 2000.

*Contents*: Many decision-making task are too complex to be understood quantitatively, however, humans succeed by using knowledge that is imprecise rather than precise. Fuzzy logic allows expressing this knowledge with subjective concepts such as "very big" and a "long time" which are mapped into exact numeric ranges. Since knowledge can be expressed in a more natural by using fuzzy sets, many decision (and engineering) problems can be greatly simplified. There are two main characteristics of fuzzy systems that give them better performance for specific applications: (i) Fuzzy systems are suitable for uncertain or approximate reasoning, especially for systems with mathematical models that are difficult to derive; (ii) Fuzzy logic allows decision making with estimated values under incomplete or uncertain information. The goal of this course to explain how to perform arithmetic operations on fuzzy numbers, how to define the (possibilistic) expected value and variance of fuzzy numbers and how to solve some simple fuzzy optimization problems.

*Components*: Lectures (12 hour) and examination.

*Literature*:

- R.Fullér, Fuzzy Reasoning and Fuzzy Optimization, TUCS General Publications, No.9, Turku Centre for Computer Science, Turku, 1998.

**Information Systems Field Development and Research**, 1 credits, IS, Professor Gary Dickson, North Carolina State University. Spring 2000.

*Contents*: The course concentrates on the development of the IS field and the research in this field. Particular focus is on experimental research. A model, with examples, will be presented for conducting experimental IS research and key issues will be explored. One goal is to design and conduct a simple experiment, possibly a project involving "hidden profiles"

*Components*: The classroom setting is a 12-hour (4 x 8 h) intensive and interactive seminar with prereadings and assignments.

*Literature*: Journal articles and research papers. To be sent and made available to all those attending prior to the sessions.

- "Management Information Systems: Evolution and Status," in Yovits, M.(ed) Advances in Computers, Vol. 20 (New York: Academic Press, 1981)
- "The Management of Information Systems Research," In A. M. Jenkins (ed), Research Issues In Management Information Systems: Setting An Agenda. Wm. C. Brown, 1990 (with G. DeSanctis)
- "A Programmatic Approach to Information Systems Research: An Experimentalist's View," In I. Benbasat (ed), The Information Systems Research Challenge: Experimental Research Methods, Boston, MA, Harvard Business School Press, 1989

- "Methodological Issues in IS Research: Experiences and Recommendations," MIS Quarterly, June, 1985 (with S.Jarvenpaa and G. DeSanctis)
- "Exploring Modes of Facilitative Support for GDSS," MIS Quarterly, June 1993, (with J-E. Lee-Partridge and L.H. Robinson)
- "Reflections on designing field research for emerging topics: the case of understanding shared knowledge creation," (with O. A. El Sawy and I. V. Eriksson)

**Information Technology and Ethics**, 3 credits, IS, Inger Eriksson, University of Turku. Fall 2000.

*Contents*: Information technology revolutionized the way in which we conduct many aspects of our lives. The tremendous technological advancement in the area of computers and related devices created unforeseen situations that necessitate new ethical consideration. Important issues like privacy, free speech, and protection of intellectual property have new meanings in the information age. The ease with which commercial values are transferred from one party to another with the help of computers and computer networks created new crimes. (Effy Oz, 1994). This course will cover central issues which information systems professionals in their future work should be aware of. Information technology is used profitably to support work, in education, at homes and in politics. However, this general use of ICT (Information and Communications Technology) involves risks as well. For an information systems professional it is essential to be aware of both the opportunities and the risks. Further, professional ethics is part of their professional competence.

*Components*: The classroom setting is a seminar format with an emphasis on close readings of texts and discussions of the various topics. There will be assignments (cf. demostrations) during the course and publishable term papers as the final test. In 2000 - 2001 this course might be given in the form of concentrated seminar sessions plus a distance education section. The course streches over the whole year.

**Seminar in Software Engineering** R. Back, 2+2 credits. Spring 2000.

**Soft Decision Analysis**, 2 credits, Professor Robert Fuller. Spring 2000, 2001.

*Contents*: The main goals of the course are to explain how to make decisions under strict uncertainty; how to make decisions with risk; how to choose appropriate aggregation operators to decision process where trade-offs are allowed; how to solve linear programming problems with soft objective function and constraints; how to model the decision maker's preferences by fuzzy sets; how to "solve" multiple objective programs using fuzzy logic.

Components: 20 h lectures, a case study and an examination.

*Literature*:

- R.Fullér, Fuzzy Reasoning and Fuzzy Optimization, TUCS General Publications, No.9, Turku Centre for Computer Science, Åbo, 1998 (270 pages). (The whole text of the book is available in pdf format for the students of the short course.)

**TUCS Seminar on Algorithmics,** 1-3 credits. Timo Järvi, University of Turku, Spring 2000.

**Visualization of Information Systems**, 2 credits, IS, Professor Gregory Wojtkowsky. Spring 2000, 2001.

*Contents:* The course consists of three major components:

- Envisioning Information
- The Visual Display of Quantitative Information
- Visual Explanations

Each topic will be dealt with during the sessions and each student is expected to choose on of the topics as their focus of study.

*Components*: The course consists of 20 contact hours, course assignments, group work and student presentations during the course and either a take-home exam, term paper or term project.

**Management of Information Technology**, 3 credits, IS, Professor Gary Dickson, North Carolina State University and Inger Eriksson, University of Turku, Department of Computer Science.

*Contents*: The first commercial computer was installed in the mid-1950s. Since then, enterprises have struggled to keep pace with the advances in computing technology in terms of how the technology has been applied and managed. This course focuses on the relationship between the nature of information technology (IT) and its management. In particular, the course will emphasize the current transition underway in which IT is moving from being managed like a high technology factory to being treated more like a research and development function emphasizing innovation, development of new and improved products and services using highly skilled, customer-oriented professionals.

*Components*: This course is delivered by way of a distance education/reading component, followed by a face-to-face case-based component, followed by a distance education/ discussion component.

*Literature*: Resource materials include: a traditional IT management text, supplemental readings, business cases, and an edited book of readings which focuses on critical IT management issues for the 21st century. In addition, the distance education component of the course utilizes the Internet and the Worldwide Web.

**Technological Change and New Ways of Working,** 2 - 5 credits, Paul Jackson. Spring 2000.

*Contents*: This course will introduce students to key theories and concepts related to new methods of work. It will place particular emphasis on the role of information technologies in supporting forms of 'virtual' working - from teleworking and virtual team, to networked and 'smart organisations. The course will set the context for this by discussing the rise of the networked society. It will place particular emphasis on change processes, and discuss the issues involved in managing and operating new methods of work.

*Components*: 24 hours of lecturing (2 credits), Seminar work (2 credits) and a book that will be announced later (1 credit).

# 8 Conference Participation

During the years 2000 and 2001, TUCS has financed conference participation and other travel expenses for a total of 858.167 FIM (year 2000 360.000 FIM and 2001 498.167 FIM), of which 622.975 FIM has been used on journeys made by postgraduate students, 111.343 FIM by postdoctoral researchers and 123.849 FIM by TUCS researchers. The departments and research projects at TUCS have also financed conference participation for the researchers.

The following conference participations have been financed by TUCS during the period:

## 8.1 Graduate Students

**Aittokallio Tero**

- Bioinformatics 2001, Skövde, Sweden, 29.3 - 1.4.2001

**Alford, Gordon**

- Sixth International Meeting on DNA Based Computers (DNA6), Leiden, The Netherlands, 13. - 17.6.2000
- STeP'2000 Conference on Artificial Intelligence, Helsinki, Finland, 28. - 31.8.2000
- Collaborative research in Leiden, The Netherlands, 23. - 29.10.2000
- Meeting of European Molecular Computing Consortium (EMCC) Milan, Italy, 3. - 5.11.2000
- European Molecular Computing Consortium (EMCC), Madrid, Spain, 11 - 12.5.2001
- P Systems Workshop, Curtea d'Arges, Romania, 20 - 25.8.2001

**Alcaraz, Francisco**

- Real Options Valuation Conference, London, UK, 16. - 17.5.2000
- Real Options Valuation Conference, London, UK, 12. - 14.6.2000

**Björklund, Dag**

- The fourth International Conference on the Unified Modelling Language (UML 2001), Toronto, Canada, 1 - 5.10.2001
- System on Chip Seminar, Tampere, Finland, 19 - 20.11.2001

**Büchi, Martin**

- 14th European Conference on Object-Oriented Programming (ECOOP 2000), Sophia Antipolis and Cannes, France, 12. - 16.6.2000

**Celiku, Orieta**

- Winter Workshop in Logics, Types and Rewriting, Edinburgh, UK, 1. - 3.2.2000
- Marktoberdorf Summer School 2001, Marktoberdorf, Germany, 24.7 - 5.8. 2001
- Theorem Proving in Higher Order Logic - Conference, Edinburgh, UK, 3 - 6.9.2001

**Cerschi, Cristina**

- The 5th International Workshop in Formal Methods for Industrial Critical Systems, Berlin, Germany, 1. - 4.4.2000
- The 14th International Conference on Theorem Proving in Higher Order Logics, Edinburgh, UK, 2 - 9.9.2001

**Codrea, Marius**

- International Conference on Image Processing, Thessalonica, Greece, 7 - 10.10.2001

**Costea, Adrian**

- IDA Spring School, Palermo, Italy, 26 - 30.3.2001
- Workshop "Software Reliability", Bucharest, Romania, 27.9.2001

**D'Incau, Davide**

- The Nokia Case Seminar, Helsinki, Finland, 28.3.2000

**Gyenesei, Attila**

- The Second Conference of PhD Students in Computer Science (CSCS), Szeged, Hungary, 20. - 23.7.2000
- The Fourth European Conference on Proncibles and Preactice of Knowledge Discovery in Databases (PKDD 2000), Lyon, France, 13. - 17.9.2000
- 2001 WSES International Conference on Fuzzy Sets&Fuzzy Systems, Spain, 11 - 15.2.2001
- A Cross-Disciplinary Workshop on Data Mining, Espoo, Finland, 5.4.2001
- The 5th European Conference on Principles and Practice of Knowledge Discovery in Databases-conference (PKDD2001), Freiburg, Germany, 3 - 7.9.2001

**Hiltunen, Jarkko**

- 2000 IEEE International Symposium on Information Theory (ISIT 2000), Sorrento, Italy, 25. - 30.6.2000
- Nokian Tutkimuskeskus, Helsinki, Finland, 12.1.2001, 23.11.2001

**Holm, Johanna**

- 8th European Conference on Information Technology Evaluation (ECITE), Oxford, UK, 17 - 18.9.2001

**Järvi, Jaakko**

- The 2nd Generative and Component-Based Software Engineering Conference (GCSE), Erfurt, Germany, 9. - 12.10.2000

**Kaitovaara, Petteri**

- Global Information Technology Management, Dallas, USA, 10 - 12.6.2001

**Kivijärvi, Juha**

- Genetic and Evolutionary Computation Conference (GECCO-2000), Las Vegas, USA, 8. - 12.7.2000
- The 4th World Multiconference on Systemics, Cybernetics and Informatics (SCI 2000), Orlando, USA, 23. - 26.7.2000
- The 6th International Conference on Information Systems, Analysis and Synthesis (ISAS 2000), Orlando, USA, 23. - 26.7.2000

**Kloptchenko, Antonina**

- IDA Spring School, Palermo, Italy, 26 - 30.3.2001
- The 24th Information Systems Research Seminar (IRIS'24), Ulvik in Hardanger, Norway, 11 - 14.8.2001

**Koskivaara, Eija**

- The 8th European Conference on Information Systems (ECIS), Vienna, Austria, 3. - 5.7.2000

**Kvassov, Vladimir**

- Hawaii International Conference on System Sciences (HICSS-33), Maui, Hawaii, USA, 4. - 7.1.2000
- 5th Conference of Association for Information Management (5th AIM Conference), Montpellier, France, 8. - 10.11.2000
- 10th International Conference on Information Systems Development, London, UK, 5 - 7.9.2001

**Lafond, Sébastien**

- System on Chip Seminar, Tampere, Helsinki, 19 - 20.11.2001

**Lainema, Timo**

- International Academy for Information Management (IAIM) 2000, Brisbane, Australia, 8. - 10.12.2000
- International Conference on Information Systems (ICIS) 2000, Brisbane, Australia, 10. - 13.12.2000
- HICSS-34,Maui, Hawaii, 3 - 6.1.2001

**Lanedri, Anas**

- IDA Spring School, Palermo, Italy, 26 - 30.3.2001
- EDEN Doctoral Seminar on Organizational Behaviour and Human Resource Management, Brussels, Belgium, 7 - 11.5.2001

**Lehtinen, Joonas**

- 11th International Conference on Image Analysis and Processing (ICIAP 2001), Palermo, Italy, 26 - 28.9.2001

**Lepistö, Arto**

- Words Conference in Palermo, Italy, 15 - 23.9.2001

**Li, Chang**

- Marktoberdorf Summer School 2001, Marktoberdorf, Germany, 24.7 - 5.8.2001

**Liang, Jianming**

- Signal Processing and Communications (SPC 2000), Marbella, Spain, 19. - 22.9.

**Liu, Shuhua**

- International Conference on Information Technology for Business Management (ITBM 2000), Beijing, China, 21. - 25.8.2000

**Mantere, Timo**

- Photonics East conference, Boston, USA, 5. - 8.11.2000
- Intelligent Robots and Computer Vision XX:Algorithms, Techniques and Active Vision-conference, Boston, USA, 28.10 - 2.11.2001

**Manuch, Ján**

- 25th International Symposium on Mathematical Foundations of Computer Science (MFCS 2000), Bratislava, Slovakia, 28.8. - 1.9.2000
- 26th International Symposium on Mathematical Foundations of Computer Science (MFCS'01), Marianske Lazne, Czech Republic, 27 - 31.8.2001
- Words 2001-conference, Palermo, Italy, 17 - 21.9.2001

**Meskanen, Tommi**

- NordSec 2001 Workshop, Lyngby, Danmark, 1 - 2.11.2001

**Munsin, Jonas**

- System on Chip Seminar, Tampere, Finland, 19 - 20.11.2001

**Nowotka, Dirk**

- Sixth International Meeting on DNA Based Computers (DNA6), Leiden, The Netherlands, 13. - 17.6.2000
- 5th International Conference on Developments in Language Theory (DLT), Vienna, Austria, 16 - 21.6.2001
- ESSLLI 2001, Helsinki, Finland, 13 - 24.8.2001
- Words 2001-conference, Palermo, Italy, 17 - 21.9.2001

**Näppi, Janne**

- 17th Symposium for Computer Applications in Radiology (SCAR 2000), Philadephia, USA, 3.6. - 17.6.2000
- 5th International Workshop on Digital Mammography (IWDM-2000), Toronto, Canada, 11. - 14.6.2000
- Computer Assisted Radiology and Surgery (CARS 2000), San Francisco, USA, 28.6. - 1.7.2000

**Petre, Ion**

- 8èmes Journées Montoises d'Informatique Théorique, Marne-la-Vallée, France, 6. - 8.3.2000
- 27th International Colloquium on Automata, Languages and Programming (ICALP' 2000), Geneva, Switzerland, 9. - 15.7.2000
- 7th International Meeting on DNA based computers (DNA 7), Tampa, Florida, USA, 10 - 13.6.2001
- 3rd International Meeting on "Words", Palermo, Italy, 17 - 21.9.2001
- Introduction to Bio informatics Seminar, Turku, 4.12.2001

**Petre, Luigia**

- International Summer School on Engineering Theories of Software Construction, Marktoberdorf, Germany, 25.7. - 6.8.2000
- 12th Nordic Workshop on Programming Theory, Bergen, Norway, 11. - 13.10.2000
- Integrating Formal Methods (IFM 2000), Schloss Dagstuhl, Germany, 1. - 3.11.2000

**Porres Paltor, Iván**

- Hawaii International Conference on System Sciences (HICSS-33), Maui, Hawaii, USA, 4. - 7.1.2000
- 14th European Conference on Object-Oriented Programming (ECOOP 2000), Sophia Antipolis and Cannes, France, 12. - 16.6.2000

- International Summer School on Engineering Theories of Software Construction, Marktoberdorf, Germany, 25.7. - 6.8.2000

**Preoteasa, Viorel**
- Mathematics for Information Technology Summer School and Workshop on Algebraic and Coalgebraic Methods in the Mathematics of Program Construction (ACMMPC), Oxford, UK, 10. - 14.4.2000
- 12th Nordic Workshop on Programming Theory, Bergen, Norway, 11. - 13.10.2000

**Puhakainen, Jussi**
- First Annual Global Information Technology Management (GITM) World Conference, Memphis, USA, 11. - 13.6.2000
- Global Information Technology Management, Dallas, USA, 10 -12.6.2001

**Ranto, Kalle**
- 2000 IEEE International Symposium on Information Theory (ISIT 2000), Sorrento, Italy, 25. - 30.6.2000

**Ranto, Sanna**
- 2000 IEEE International Symposium on Information Theory (ISIT 2000), Sorrento, Italy, 25. - 30.6.2000
- 14th AAEECC Symposium (Applied Algebra, Algebraic Algorithms and Error Correcting Codes), Melbourne, Australia, 26 - 30.11.2001

**Rosendahl, Petri**
- 14th AAEECC Symposium (Applied Algebra, Algebraic Algorithms and Error Correcting Codes), Melbourne, Australia, 26 - 30.11.2001

**Rönkkö, Mauno**
- Tietojenkäsittelytieteen päivät, Jyväskylä, Finland, 22. - 23.5.2000

**Salehi, Saeed**
- Logic Colloquium 2001, Vienna, Austria, 6 - 11.8.2001

**Smed, Jouni**
- Group Technology/Cellular Manufacturing World Symposium - Year 2000, San Juan, Puerto Rico, 27. - 29.3.2000
- International Conference on Application and Development of Computer Games in the 21st Century, Hong Kong, China, 22 - 23.11.2001

**Syrjänen, Elina**
- Making Medical Informatics Work (MMIW) Conference, Manchester, UK, 18. - 19.2.2000
- European Conference on Information Systems (ECIS 2000), Vienna, Austria, 3. - 5.7.2000

**Tétard, Franck**
- Hawaii International Conference on System Sciences (HICSS-33), Maui, Hawaii, USA, 4. - 7.1.2000
- Americas Conference on Information Systems (AMCIS) 2000, Long Beach, USA, 10. - 13.8.2000

- International Society for Decision Support Systems, 6th International Conference (ISDSS), London, UK, 2 - 4.7.2001
- Americas Conference on Information Systems (AMCIS), Boston, USA, 3 - 5.8.2001

**Truscan, Dragos**
- Enabling Technologies for System-on-Chip Development (SoC) 2000 conference, Tampere, Finland, 15. - 16.11.2000
- Application-Specific Multi-Processor SoC Summer School, Grenoble Cedex, France, 9 - 13.7.2001
- FDL'01 Conference, Lyon, France, 3 - 7.9.2001
- System on Chip Seminar, Tampere, Finland, 19 - 20.11.2001

**Tuomisto, Antti**
- IRIS 23 conference, Uddevalla, Sweden, 12. - 15.8.2000

**Turunen, Pekka**
- Health Care Computing 2000 Conference, Harrogate, UK, 20. - 22.3.2000
- Research visit to Maastricht, Germany, starting 3.4.2000
- 7th European Conference on IT Evaluation (ECITE 2000), Dublin, Ireland, 28. - 29.9.2000
- 8th European Conference on Evaluation of Information Technology (8th ECEIT), Oxford, UK, 16 - 18.9.2001
- Research visit to England, 2001

**Valtonen, Tuomas**
- NorChip 2001 Conference, Kista, Sweden, 12 - 13.11.2001

**Virtanen, Pentti**
- Reengineering Week 2000 Zurich, Zurich, Switzerland, 29.2. - 3.3.2000
- Escom-Scope conference 2000, Munich, Germany, 18. - 20.4.2000
- ESCOM-SCOPE 2001 & METRICS 2001, London, Great Britain, 2.4 - 6.4. 2001

**Virtanen, Seppo**
- Electronic Design Automation conference (EDA-Träff 2000), Stockholm, Sweden, 11.4.2000
- The 18th IEEE Norchip Conference, Turku, Finland, 6. - 7.11.2000
- Enabling Technologies for System-on Chip Development (SoC) 2000 conference, Tampere, Finland, 15. - 16.11.2000
- Uuden tietoliikennealan teknologiaohjelman valmisteluseminaari, Hki, Finland, 13.2.2001
- The 9th Internat.Symposium on Hardware/Software Codesing, Copenhagen, DK, 25 - 27.4.2001
- FDL'01 Forum on Design Languages, Lyon, France, 3 - 6.9.2001
- System-on-Chip 2001 seminar, Tampere, Finland, 19 - 20.11.2001

**Yan, Lu**
- 11th Jyväskylä Summer School, Jyväskylä, Finland, 30.7 - 17.8.2001
- Formalware Engineering-Formal Methods for Engineering Software, Udine, Italy, 24 - 28.9.2001

## 8.2 Postdoctoral Researchers

**Holub, Stepan**

- Words'01-conference, Palermo, Italy, 17 - 21.9.2001

**Järvi, Jaakko**

- European Conference on Object Oriented Programming, Budapest, Hungary, 18 - 22.6.2001
- ACM Conference on Object-Oriented Programming, Systems, Languages and Applications (OOPSLA 2001), Tampa Bay, USA, 12 - 20.10.2001

**Kaukoranta, Timo**

- Konenäkö robotiikassa-seminaari, Tampere, Finland, 20.3.2001
- 3rd International Conference on Information Communications and Signal Processing (ISICS 2001), Singapore, 15 - 18.10.2000

**Pasanen, Tomi**

- Rolf Nevalinna-palkittujen seminaari, Helsinki, Finland, 5.9.2000
- Tieteen Päivät, Helsinki, 10 - 13.1.2001
- Bioinformatics 2001, Skövde, Sweden, 29.3 - 1.4.2001
- ESA 2001, WAE 2001 and WABI 2001, Århus, Denmark, 28 - 31.8.2001

**Petkovic, Tatjana**

- The Third International Colloquium on Words, Languages and Combinatorics (ICWLC), Kyoto, Japan, 14. - 18.3.2000
- Colloquium on Semigroups, Szeged, Hungary, 17. - 21.7.2000
- Rolf Nevalinna-palkittujen seminaari, Helsinki, Finland, 5.9.2000

**Zhou, Xinrong**

- IEEE Asia-Pacific International Symposium on Cluster Computing (APSCC'2000), Beijing, China, 14. - 17.5.2000

## 8.3 Researchers

**Boberg, Jorma**

- Bioinformatics 2001, Skövde, Sweden, 29.3 - 1.4.2001

**Elfving, Henrik**

- Study trip to San Francisco, 16.9 - 6.10.2001

**Järvinen, Jouni**

- Third International Conference on Discrete Mathematics and Theoretical Computer Science (DMTCS'2001), Constantza, Romania, 2 - 6.7.2001
- 13th International Symposium on Fundamentals of Computation Theory (FCT 2001), Riga, Latvia, 22 - 24.8.2001
- Bioinformatiikkapalaveri, Helsinki, 20.11.2001

**Karsten, Eija**

- Realigning Research and Practice in IS Development: The Social and Organisational Perspective, 27 - 29.7.2001

**Nurminen, Markku I.**

- 24th Information Systems Research Seminar in Scandinavia (IRIS'24), Ulvik in Hardanger, Norway, 11 - 14.8.2001

**Steinby, Magnus**

- The Third International Colloquium on Words, Languages and Combinatorics, Kyoto, Japan, 14. - 18.3.2000

**Tuomisto, Antti**

- 24th Information Systems Research Seminar in Scandinavia (IRIS'24), Ulvik in Hardanger, Norway, 11 - 14.8.2001

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3. **Christer Carlsson (Editor)**, Exploring the Limits of Support Systems
4. **Mats Aspnäs, Ralph-Johan Back, Timo Järvi, Tiina Lehto (Eds.)**, Turku Centre for Computer Science, Annual Report 1996
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6. Working Material from the School on Natural Computation, SNAC
7. **Mats Aspnäs, Ralph-Johan Back, Timo Järvi, Tiina Lehto (Eds.)**, Turku Centre for Computer Science, Annual Report 1997
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9. **Robert Fullér**, Fuzzy Reasoning and Fuzzy Optimization
10. **Wolfgang Weck, Jan Bosch, Clemens Szyperski (Eds.)**, Proceedings of the Third International Workshop on Component–Oriented Programming (WCOP '98)
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14. **Mats Aspnäs, Ralph-Johan Back, Timo Järvi, Martti Kuutti, Tiina Lehto (Eds.)**, Turku Centre for Computer Science, Annual Report 1998
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21. **Johan Lilius, Seppo Virtanen (Eds.)**, TTA Workshop Notes 2002
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