COMPUTER SCIENCE IN TARTU:

Research and Education

University of Tartu

University of Tartu

- The University of Tartu (UT) is the **oldest and largest** university of Estonia and one of the best-known in Northern and Eastern Europe. From its foundation in 1632 to the first decades of the XX century UT was the only university in the Northern Baltic region.

- **Classical university** - with its eleven faculties, UT is the only classical university of Estonia. It also includes three specialized research institutions. UT has launched its regional program, in the framework of which it has established a network of six UT colleges located each in a different city.

11 Faculties

Faculty of Theology
Faculty of Law
Faculty of Medicine
Faculty of Philosophy
Faculty of Biology and Geography
Faculty of Economics and Business Administration
Faculty of Education
Faculty of Exercise and Sport Sciences
Faculty of Physics and Chemistry
Faculty of Social Sciences

Faculty of Mathematics and Computer Science

3 Research institutes

Institute of Physics

Estonian Marine Institute

Institute of Technology

6 Colleges and Open University

- EuroCollege
- Narva College
- Pärnu College
- Türi College
- Teacher Training College
- The Institute of Law

- Distance Learning Centre – Open University

Faculty of Mathematics and Computer Science

Faculty of Mathematics and Computer Science

- History
    - 1802 – chair of mathematics at the faculty of philosophy
    - 1850 – faculty of mathematics and physics
    - 1919 – faculty of mathematics and nature sciences
    - 1961 – faculty of mathematics and physics
    - 1967 – faculty of mathematics
    - 2001 – faculty of mathematics and computer science

Faculty of Mathematics and Computer Science

- 4 institutes (pure mathematics, applied mathematics, mathematical statistics, computer science)
  - 58 lecturers
  - 14 researchers
  - 826 students (47 PhD students)
  - 3 Curricula on PhD level
  - 6 Curricula on Master's level
  - 4 Curricula on Bachelor's level
  - 2 Teacher training curricula

Institute of Computer Science

- History
  - 1969 – Department of mathematical statistics and programming
  - 1979 – Department of programming
  - 1993 – re-structuring of the University: institutes at faculties => Institute of Computer Science

Institute of Computer Science

- 5 chairs: Theoretical Computer Science (1993), Software Systems (1993), Language Technology (2001), Cryptography (2004), Distributed Systems (2004)

  - 18 lecturers
  - 6 researchers
  - 22 PhD students, 54 Master students
  - 1 Curriculum on PhD level (computer science)
  - 2 Curricula on Master's level (computer science, information technology)
  - 2 Curricula on Bachelor's level (computer science, information technology)
  - 1 Teacher training curriculum (teacher of computer science)

RESEARCH:
Institute of Computer Science

- Due to specifics of teaching, institute research has to cover as many different areas as possible in computer science.

- Therefore the research is organized by small teams.

RESEARCH:
Institute of Computer Science

The main fields of scientific research:

– public key infrastructure (specifically, time stamping)
– provability in cryptography
– algebraic methods in computer science,
– counting and decomposition of Boolean functions
– algorithmics
– functional programming
– compiler technology
– static program analysis (specifically, multi-thread program analysis, security analysis)
– sketchy programming
– computer aided teaching & e-learning
– language technology

RESEARCH:
Tartu University Institute of Technology

- Research and development institution, which aims to create a new cultural environment to facilitate the generation of new technological solutions. The Institute was established in June 2001.

- The R&D centres are being established in the following areas:
  - Material and chemical technology
  - Biomedical technology
  - Environmental technology
  - **Information technology**

RESEARCH:
Tartu University Institute of Technology

Research projects at the centre of Information technology

- Agents and their behaviour in real world (Dr. Merik Meriste)

- Interactivity ontologies, multi agent systems and time (Dr. Merik Meriste)

- WWW-based scientific computation environment for solving big problems on parallel computer (Dr. Eero Vainikko)

- Silent devices: materials and control algorithms (Dr. Alvo Aabloo)

Research cooperation in Estonia

1. Centre for Dependable Computing (CDC)
- One of 10 centres of excellence in research (2002-2006)
- Participants
  - Tallinn University of Technology (TUT)
    - Institute of Cybernetics (research institute)
    - Institute of Computer Scince
    - Institute of Computer technology
    - Institute of Automatics
  - University of Tartu
    - Institute of Computer Science
    - Institute of Technology
  - Cybernetica AS (information security, information systems and navigation systems development company)

Research cooperation in Estonia

2. The Laboratory of Data Security (1997) - a joint laboratory of Cybernetica AS and the University of Tartu. Research is coordinated by Cybernetica AS

3. The language technology group is working in cooperation with the chair of General Linguistics (Faculty of Philosophy of UT), Research Institute of Estonian Language, and Institute of Cybernetics of TUT

International cooperation

- Nordic Treebank Network on language technology

- E-learning networks

- Many personal contacts

EDUCATION

- New model of higher education since 2002/2003 (Bologna declaration): 3+2 years

  3 (Bachelor) +2 (Master)   [+4 PhD]

  1 year   = 40 credits (AP)

  1 credit = 40 hours of student's work

- 1 curriculum on PhD level (Computer Science)
- 2 curricula on Master's level (Computer Science, Information Technology)
- 2 curricula on Bachelor's level (Computer Science, Information Technology)
- 1 teacher training curriculum (Teacher of Computer Science)

EDUCATION

- **Bachelor's studies (120 AP)**
  - 2 basic modules 16+16 AP
  - 2 direction modules 16+16 AP
  - 2 modules of specialization 16+16 AP
  - Optional courses 12 AP (list given)
  - Free courses 8 AP
  - Bachelor's thesis 4 AP
- **Master's studies (+80 AP)**
  - courses 60 AP
  - Master's thesis 20 AP
- **[PhD studies (+160 AP)]**
  - courses 40 AP
  - PhD thesis 120 AP

Computer Science curriculum: Bachelor's studies…

- 2 basic modules, á 16 AP (fixed):

  1st module: algebra and geometry (4 AP), mathematical analysis I (4 AP), programming (4 AP), introduction to physics (4 AP)

  2nd module: object oriented programming (4 AP), set theory and mathematical logic (2 AP), mathematical analysis II (4 AP), computer hardware I (2 AP), electrical measures (2 AP), data analysis (2 AP)

…Computer Science curriculum: Bachelor's studies…

- 2 direction modules (á 16 AP, to choose)

  1. **Computer science** (algorithms and data structures, introduction to mathematical logics, operating systems, elements of discrete mathematics, network technology)

  2. **Theoretical computer science** (method of logical programming, algebra I, data base theory, graphs, method of functional programming)

  3. **Language technology** (introduction to computational linguistics, corpus linguistics, introduction to general linguistics, data base theory, language technology)

…Computer Science curriculum: Bachelor's studies

- 2 modules of specialization (á 16 AP, to choose)
  1. **Computer science** (software engineering, artificial intelligence I, data security, automata, languages and translators)
  2. **Software systems** (application software: Internet/ TEX/ Perl/SAS/MathCAD/Oracle/Access, data bases, workstation software, standards, information systems, software project)
  3. **Computer Science in education**
  4. **Mathematics for computer scientists** (algebra II, number theory, probability theory, mathematical statistics, application software: TEX)

Computer Science curriculum: Master's studies

- Specializations
  - Theoretical computer science
  - Language technology
  - Cryptography
- For every specialization
  - Obligatory courses 32 AP
  - Optional courses 16 AP (list given)
  - Master's seminar 4 AP
  - Didactics of Computer Science 4 AP
  - Free courses 4 AP
  - Thesis 20 AP

Information Technology Curriculum: Bachelor's studies…

- 2 basic modules, á 16 AP (fixed, the same as for CS):

  1st module: algebra and geometry (4 AP), mathematical analysis I (4 AP), programming (4 AP), introduction to physics (4 AP)

  2nd module: object oriented programming (4 AP), set theory and mathematical logic (2 AP), mathematical analysis II (4 AP), computer hardware I (2 AP), electrical measures (2 AP), data analysis (2 AP)

… Information Technology Curriculum: Bachelor's studies…

- 2 direction modules (á 16 AP, to choose), cooperation with the Faculty of Physics and Chemistry

  1. **Information technology** (information standards, basics of telecommunication, algorithms and data structures, elements of discrete mathematics, network theory, real time systems)

  2. **Hardware** (practical work in telecommunication, engineering graphics, electronics, microprocessors, practical work in electronics, electrical chains)

  3. **Software** (application software: Internet/ TEX/ Perl/SAS/MathCAD/Oracle/Access, method of functional programming, workstation software, method of logical programming, introduction to mathematical logic, information systems)

…Information Technology Curriculum: Bachelor's studies

- 2 modules of specialization (á 16 AP, to choose)

  1. **Information technology** (data security, multimedia, data bases, network technology II, project management, basics of signal processing)

  2. **Hardware** (computer physics, hardware project, computer hardware II, computer components, computer-managed measures, quality management)

  3. **Software** (software technology, system management, web information systems, operating systems, software project)

Information Technology Curriculum: Master's studies

- Specializations
  - Software
  - Hardware

- For every specialization
  - Obligatory courses 32 AP
  - Optional courses 8 AP (list given)
  - Master's seminar 4 AP
  - Methodics of consultative work 4 AP
  - Practical experiences in Information Technology 8 AP
  - Free courses 4 AP
  - Thesis 20 AP