JACOBS UNIVERSITY

INTRODUCTION TO COMPUTER SCIENCE 3.0

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Computer Science
Bremen, Spring 2021

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CHAPTER 1
ORGANIZATION

FOCUS AREAS AND DEPARTMENTS

JACOBS UNIVERSITY

- Focus Area **Mobility – of People, Goods, and Information**
  - Department of **Computer Science and Electrical Engineering**
  - Department of Mathematics and Logistics

- Focus Area Health – Focus on Bioactive Substances
  - Department of Life Sciences and Chemistry
  - Department of Physics and Earth Sciences

- Focus Area Diversity – in Modern Societies
  - Department of Business and Economics
  - Department of Social Sciences and Humanities
  - Department of Psychology and Methods

STUDY PROGRAMS IN THE FOCUS AREA MOBILITY – OF PEOPLE, GOODS, AND INFORMATION

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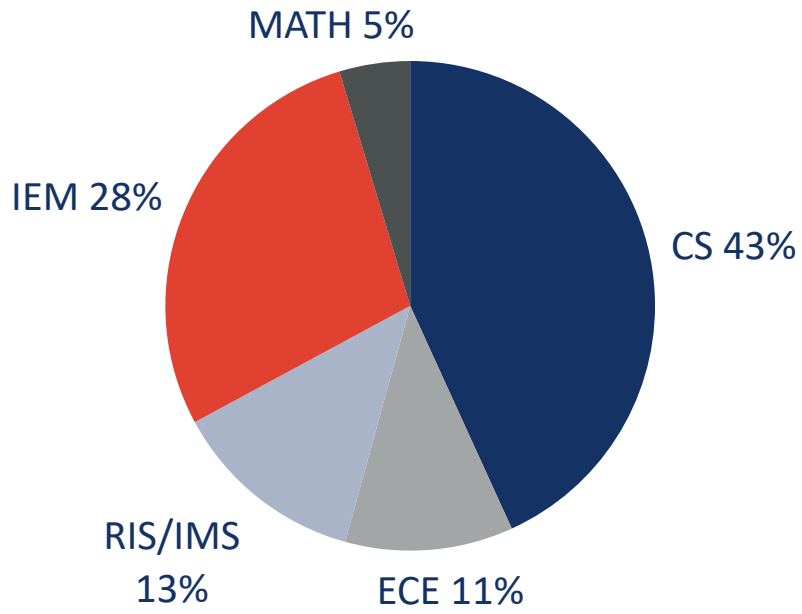
Undergraduate Programs (BSc)

- **Computer Science** (CS)
- Electrical and Computer Engineering (ECE)
- Robotics and Intelligent Systems (RIS)
  formerly Intelligent Mobile Systems (IMS)
- Industrial Engineering and Management (IEM)
- Mathematics (MATH)

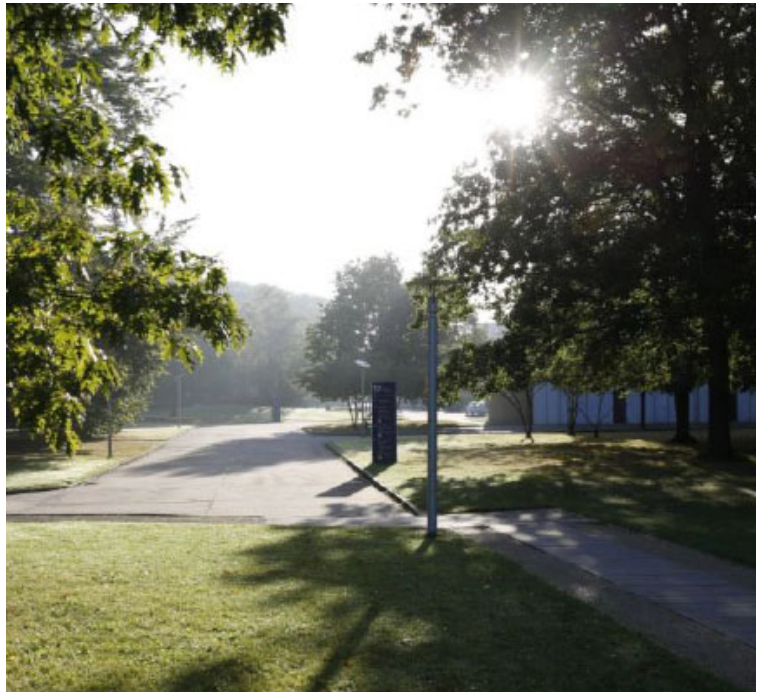
Graduate Programs (MSc)

- Data Engineering (DE)
- Supply Chain Management (SCM)



[Data as of Fall 2020]

CHAPTER 2
GENERAL INFORMATION FOR STUDENTS



WHAT IS COMPUTER SCIENCE?

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- Computer science is the study of *processes that interact with data* and that can be *represented as data in the form of programs*. It enables the *use of algorithms to manipulate, store, and communicate digital information*. A computer scientist studies the *theory of computation* and the *practice of designing software systems*. [Wikipedia, 2019-08-27]

- Computer Science is a branch of science that deals with the *theory of computation* or the *design of computers*. [Merriam-Webster 2019-08-27]

- Computer science is the *study of computers* and *algorithmic processes*, including their *principles*, their *hardware and software designs*, their *applications*, and their *impact on society*. [ACM 2003]

LESLIE LAMPORT (TURING AWARD WINNER FOR HIS WORK ON CONCURRENCY) ON COMPUTER SCIENCE EDUCATION

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- A defining characteristic of computing is the *need for rigor*.
- A *problem must be understood before it can be solved*. The great contribution of Dijkstra's paper on mutual exclusion was not his solution; it was stating the problem.
- *Education is not the accumulation of facts*. It matters little what a student knows after taking a course. *What matters is what the student is able to do after taking the course*. I have seldom met engineers who were hampered by not knowing facts about concurrency. I have met quite a few who lacked the basic skills they needed to think clearly about what they were doing.

WHY STUDY COMPUTER SCIENCE?

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- Computer Science is the *key discipline* driving today's globalized information society
- *Excellent job opportunities* world-wide in information technology and engineering companies
- Computer Science education trains your *abstract thinking skills, opening many career paths* outside information technology centered businesses
- It can be a lot of *fun to understand how things around you work*, to dig behind the user interface, and to build something new

CAREER PATHS: GRADUATE SCHOOLS

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- ETH Zürich (CH)
- EPFL Lausanne (CH)
- RWTH Aachen (DE)
- TU Berlin (DE)
- Technical University Munich (DE)
- Carnegie Mellon University (USA)
- Cornell University (USA)
- University of Montreal (CA)
- VU Amsterdam (NL)
- TU Delft (NL)
- University College London (UK)
- University of Cambridge (UK)
- University of Oxford (UK)
- …

CAREER PATHS: INDUSTRY

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- Microsoft, Skype
- Google
- Amazon
- Facebook
- Twitter
- Vmware
- Apple
- SAP (Walldorf)
- 360 Treasury Systems AG (Frankfurt)
- CleverSoft GmbH (Munich)
- Research Gate (Berlin)
- …

CHE RANKINGS (INFORMATIK)

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CHE Ranking 2015 (out of 68 programs)

- 1st in the categories “teachers”, “teacher support”, “courses offered”, “research orientation”, and “support for stays abroad”
- 2nd in the categories “contact to students”, “support during initial phase of studies”, “overall study situation”, “study organization”, and “job market preparation”
- 7th in the category “third party funds per academic”

CHE Ranking 2012 (out of 78 programs)

- 3rd in the category “overall study situation”
- 12th in the category “3rd party funds per academic”

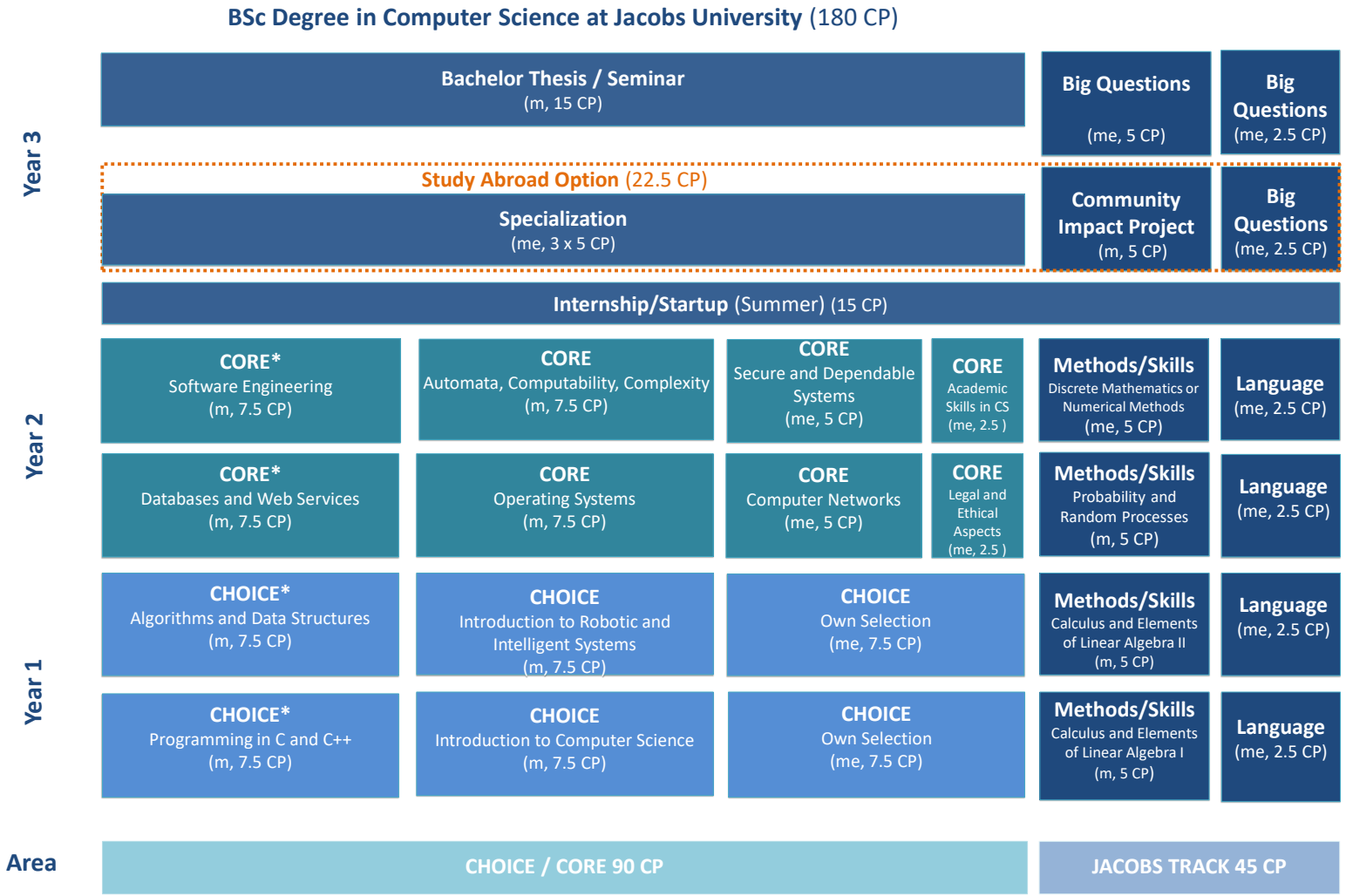
CHE Ranking 2009 (out of 67 programs)

- 1st in the category “overall study situation”
- top group in the category “teacher support”

CHE
Centre for Higher Education

CHAPTER 3
COMPUTER SCIENCE PROGRAM

COMPUTER SCIENCE SCHEMATIC STUDY PLAN



1ST YEAR COMPUTER SCIENCE

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	Module	Credits	Semester	Comment
Computer Science 30 CP	Introduction to Computer Science	7.5 CP	1st (Fall)	mandatory
	Programming in C and C++	7.5 CP	1st (Fall)	mandatory
	Algorithms and Data Structures	7.5 CP	2nd (Spring)	mandatory
	Introduction to Robotics and Intelligent Systems	7.5 CP	2nd (Spring)	mandatory
Methods 10 CP	Calculus and Linear Algebra I	5.0 CP	1st (Fall)	mandatory
	Calculus and Linear Algebra II	5.0 CP	2nd (Spring)	mandatory
Languages 5 CP	German (for most students)	2.5 CP	1st (Fall)	mandatory
	German (for most students)	2.5 CP	2nd (Spring)	mandatory
Electives 15 CP	*selected CHOICE module*	7.5 CP	1st (Fall)	elective
	selected CHOICE module	7.5 CP	2nd (Spring)	elective

2ND YEAR COMPUTER SCIENCE

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	Module	Credits	Semester	Comment
Computer Science 45 CP / 30 CP (minor)	Databases and Web Services	7.5 CP	3rd (Fall)	mandatory
	Operating Systems	7.5 CP	3rd (Fall)	mandatory
	Computer Networks	5.0 CP	3rd (Fall)	mandatory (unless minor)
	Legal and Ethical Aspects of Computer Science	2.5 CP	3rd (Fall)	mandatory (unless minor)
	Software Engineering	7.5 CP	4th (Spring)	mandatory
	Automata, Computability, and Complexity	7.5 CP	4th (Spring)	mandatory
	Secure and Dependable Systems	5.0 CP	4th (Spring)	mandatory (unless minor)
	Academic Skills in Computer Science	2.5 CP	4th (Spring)	mandatory (unless minor)
Methods 10 CP	Probability and Random Processes	5.0 CP	3rd (Fall)	mandatory
	Discrete Mathematics OR Numerical Methods	5.0 CP	4th (Spring)	mandatory (choose one)
Languages 5 CP	German (for most students)	2.5 CP	3rd (Fall)	mandatory
	German (for most students)	2.5 CP	4th (Spring)	mandatory

3RD YEAR COMPUTER SCIENCE

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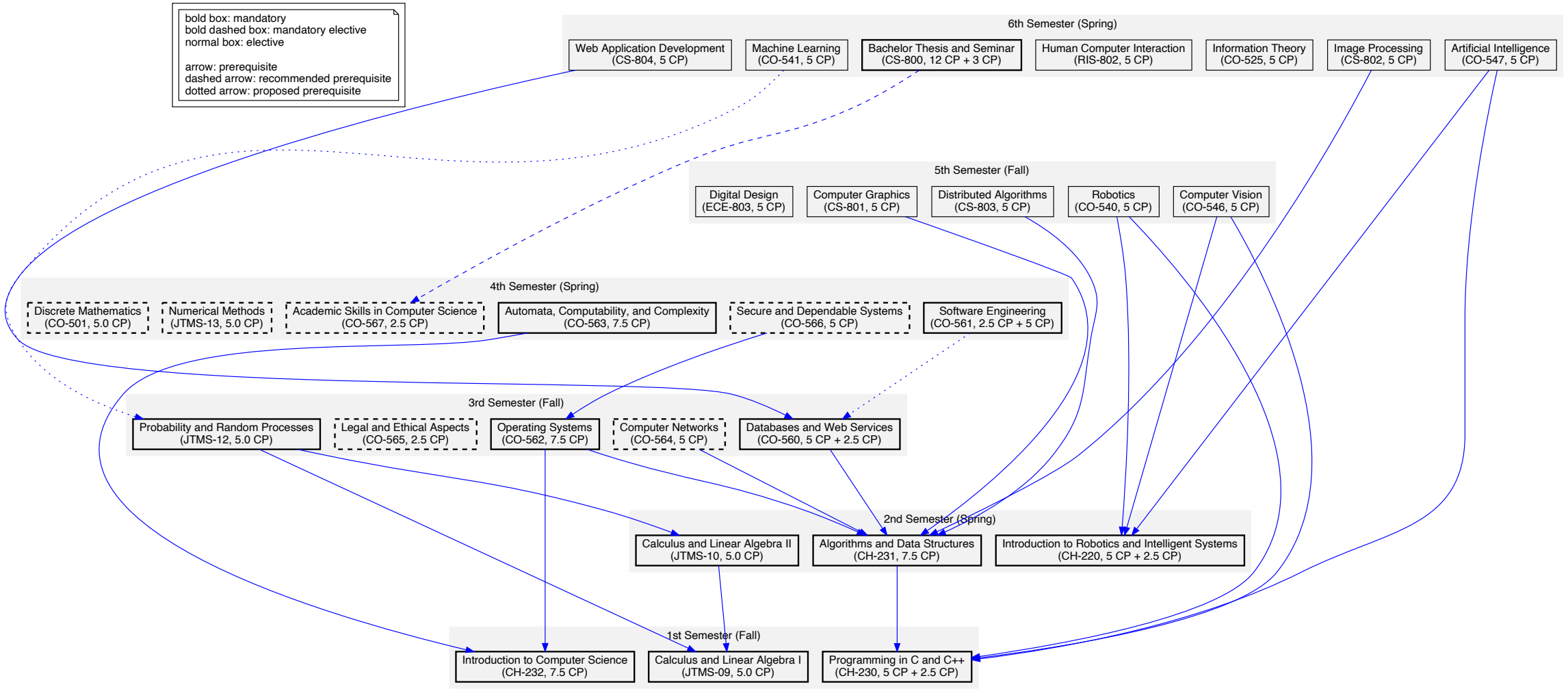
	Module	Credits	Semester	Comment
Computer Science 30 CP	Computer Graphics	5.0 CP	5th (Fall)	elective
	Image Processing	5.0 CP	6th (Fall)	elective
	Distributed Algorithms	5.0 CP	5th (Fall)	elective
	Web Application Development	5.0 CP	5th (Fall)	elective
	Human Computer Interaction (RIS)	5.0 CP	6th (Spring)	elective
	Artificial Intelligence (RIS)	5.0 CP	6th (Spring)	elective
	Robotics (RIS)	5.0 CP	5th (Fall)	elective
	Machine Learning (RIS)	5.0 CP	6th (Spring)	elective
	Computer Vision (RIS)	5.0 CP	5th (Fall)	elective
	Digital Design (ECE)	5.0 CP	5th (Fall)	elective
	Information Theory (ECE)	5.0 CP	6th (Spring)	elective
	Bachelor Thesis and Seminar	15 CP	6th (Spring)	mandatory
Others 30 CP	Internship	15 CP	Summer	mandatory
	Big Questions and Community Impact Project	15 CP	5th/6th	mandatory

CS MODULES: DEPENDENCIES AND PREREQUISITES



MINOR OPTIONS FOR COMPUTER SCIENCE STUDENTS

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- Medicinal Chemistry and Chemical Biology (MCCB)
- Earth and Environmental Science (EES)
- Physics (PHY)
- Mathematics (MATH)
- Robotics and Intelligent Systems (RIS)
- Electrical and Computer Engineering (ECE)
- Industrial Engineering and Management (IEM)
- Global Economics and Management (GEM)
- International Relations: Politics and History (IRPH)
- Integrated Social and Cognitive Psychology (ISCP)

MAJOR CHANGE OPTIONS FOR COMPUTER SCIENCE STUDENTS

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- Robotics and Intelligent Systems (RIS)
  - No additional CHOICE module required
- Electrical and Computer Engineering (ECE)
  - CHOICE: General Electrical Engineering I
  - CHOICE: General Electrical Engineering II
- Earth and Environmental Sciences (EES)
  - CHOICE: General Earth and Environmental Sciences
  - CHOICE: General Geology
- Physics (PHY)
  - CHOICE: Classical Physics
  - CHOICE: Modern Physics
- International Relations: Politics and History (IRPH)
  - CHOICE: Introduction to International Relations
  - CHOICE: Theory and Introduction to Modern European History
- Integrated Social and Cognitive Psychology (ISCP)
  - CHOICE: Essentials of Cognitive Psychology
  - CHOICE: Essentials of Social Psychology

- The “free” CHOICE modules in the first two semesters determine your possible major change options.
- What are you interested in? Follow your interests (and not what others tell you)!
- Combining CS with ECE or PHY is recommended only for students who are very strong in maths and physics
- If you are unsure, select CHOICE modules that are less math-oriented (exit option)

EXCHANGES AND OTHER ACTIVITIES

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- Exchange program with Carnegie Mellon University (USA)
- ACM Northwestern European Regional Contests (NWERC)
- International hackathon (jacobsHack!) organized by CS students
- Students working successfully on Google Summer of Code projects

- CS club actively shapes the CS community on our campus. Joint it!

COMPUTER SCIENCE FACULTY

Prof. Peter Baumann

Prof. Andreas Birk

Prof. Horst Hahn

Dr. Sergey Kosov

Dr. Kinga Lipskoch

Prof. Francesco Maurelli

Prof. Jürgen Schönwälder

Prof. Peter Zaspel

COMPUTER SCIENCE RESEARCH

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- Large-Scale Scientific Information Systems (Prof. Peter Baumann)
- Robotics (Prof. Andreas Birk)
- Medical Imaging (Prof. Horst Hahn)
- Marine Systems (Prof. Francesco Maurelli)
- Computer Networks and Distributed Systems (Prof. Jürgen Schönwälder)
- Scalable Computing (Prof. Peter Zaspel)

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THANK YOU FOR YOUR ATTENTION

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