ICT-Module
Winter Semester 2019/20

Language of Instruction: English
Stand: 13. Mai 2019
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<td><strong>Total</strong></td>
<td><strong>47 ECTS</strong></td>
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(Subject to alterations)
In addition, we offer German language classes on beginners and advanced levels comprising 6 ECTS per semester.

Course Information:

**MIS – Computer Architecture**

During the introductory course on computer architecture students acquire theoretical and practical knowledge on the three fundamental layers of computer designs: 1) On digital logic layer basic building blocks such as gates, ALUs, flip-flops or registers and their inter-connections will be studied. 2) The instruction set architecture (ISA) layer defines various instruction types and addressing modes as well as differences between them (RISC/CISC architectures). 3) Finally, on data-path layer the lessons learned during phases 1) & 2) will be combined to analyze a simplified MIPS data-path. This necessitates to look at concepts such as pipelining, pipeline hazards and cache architectures. In order to offer students a richer learning experience, an intensive amount of hands-on exercises based on different simulation tools have been added to the course curriculum.

*After this course, a student is able to*

- Construct more complex circuits (e.g. a memory element) out of basic circuit blocks (e.g. latch).
- Formulate the compromises and development criteria of an ISA
- Understand the functionality of a simplified MIPS CPU
- Evaluate the processing power of a MIPS CPU by a simulation tool
- Gather information on different layers of various computer architectures (Hardware level data-sheets, ISA Specifications).
- Construct and simulate digital logic elements by a simulation tool
MIS – Privacy Enhancing Technologies and Big Data
This lecture focuses on two main goals: provide a state-of-the-art introduction to Privacy Enhancing Technologies (PETs) as well as an overview on methods for big data analysis. In the first part of this lecture the focus therefore lies on: anonymity systems, onion routing, applied cryptography, web privacy, censorship, and transport layer security. Hereby, the theoretical concepts are discussed.
In lectures and the concepts are applied within practical assignments in the following. The big data part of the lecture follows a similar route, whereas state-of-art tools and methods such as merge-and-reduce are theoretically discussed and applied in practical assignments.

BIS – Research Project
The seminar paper covers a topic in one of the following five focus areas of the IT-security study program:

- Internet Security and Privacy
- Infrastructure and Industrial Security
- Software Security
- Digital Forensics
- Information Security Management

BIS – Operation Systems Hardening
Students learn about:

- File systems, software RAID, LUKS, error handling in Linux
- Backups, configuration management, Cron
- Python for administration tasks, Regex
- HIDS (Host based intrusion Detection)
- PAM (Pluggable Authentication Module)
- Kernel hardening, GR security, make, virtualization, Kernel compilation
- Auditing (SSH hardening, password security, password cracking,...)
- Server landscape configuration

MCS – Academic Research
The course Academic Research provides an overview of the fundamentals of scientific research and writing. This includes:

- Literature research
- Citation
- Plagiarism
- LaTex / BibTeX
MCS – Scientific Presentation
- In the lecture Scientific Presentation, students learn how to present scientific results in the English language in the form of an oral presentation.

MCS – Theoretical Computer Science
This course covers important content in the field of theoretical computer science which is needed to work on research questions.
Important teaching content includes:
- Basic concepts of semiotics: syntax, semantics and pragmatics according to Pierce; application of these concepts to different types of information; model concepts for processing of information
- Basic concepts of complexity theory
- Introduction to the theory of formal languages
- Predictability theory
- Introduction to logic

MCS – Foundations of Science and Research
This introductory seminar aims at providing the students with an overview of scientific writing and background information on the philosophy of science.
The seminar deals with the following topics:
- Epistemology
- Structure of scientific papers
- Fundamentals of methodology and research design
- Fundamentals of literature research (scientific literature, research, citation, literature management)
- Where applicable: additional topics such as academic language use, working tools, time management

The aim is to create a paper which discusses and critically questions the scientific methods used by a research institution.

MCS – Design of Experiments
- Planning, execution and evaluation of experiments
- Fundamentals of technical statistics
- Procedure of planning experiments
- Systematic observation
- Full-factorial design
- Experiments with central point and centrally assembled design
- Partial-factorial design
- Optimisation
MCS – Design Thinking

- Fundamentals of Design Thinking
- The Design Thinking Process Model as an example of a design process
- Design Thinking mindset and principles
- Influences and origins of Design Thinking
- Design methods in Design Thinking
- Characteristics, goals and results of individual Design Thinking phases
  - Getting to know the context of the problem
  - Finding out the users’ needs through empathy
  - Defining perspectives
  - Generating and (further) developing ideas
  - Turning ideas into prototypes
  - Testing prototypes for idea development

Furthermore, students learn about the most important terms, concepts and methods from the following areas of requirements management:

- Requirements analysis, creation of requirements documents, preparation of cost estimate, communication with the customer, creating proposals/offers
- Modern tools and best practices regarding the topic "requirements and processes"

MCS – Innovation, Research and Entrepreneurship

- This course is an introduction to entrepreneurship and innovation. It deals with the different aspects of innovation management as well as basic definitions of the conceptual framework of innovation and entrepreneurship. In addition, the students should develop an understanding of the reasons leading to innovation resistance and learn more about stakeholder analysis.
- It also covers methods for identifying innovation possibilities, the planning of new venture possibilities and the evaluation of business ideas and concepts. Students learn about the different types of business models and develop evaluation skills concerning the market and technology potential of innovations. Another focus is on the financing of start-ups.