Module Catalogue
for the Module studies (Bachelor)
Computer Science

Examination regulations version: 2019
Responsible: Institute of Computer Science
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Abbreviations used

Course types: E = field trip, K = colloquium, O = conversatorium, P = placement/lab course, R = project, S = seminar, T = tutorial, Ü = exercise, V = lecture

Term: SS = summer semester, WS = winter semester

Methods of grading: NUM = numerical grade, B/NB = (not) successfully completed

Regulations: (L)ASPO = general academic and examination regulations (for teaching-degree programmes), FSB = subject-specific provisions, SFB = list of modules

Other: A = thesis, LV = course(s), PL = assessment(s), TN = participants, VL = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

15-May-2019 (2019-36)
27-Jun-2019 (2019-41)
14-Nov-2019 (2019-52)
22-Jan-2020 (2020-13)
06-May-2020 (2020-39)
22-Jul-2020 (2020-57)
17-Dec-2020 (2020-110)
10-Mar-2021 (2021-17)
This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.
Summer Term 2019

(0 ECTS credits)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<td>Algorithmic Graph Theory</td>
<td>10-I-AGT-152-m01</td>
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<td>holder of the Chair of Computer Science I</td>
<td>Institute of Computer Science</td>
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<th>ECTS</th>
<th>Method of grading</th>
<th>Module level</th>
<th>Other prerequisites</th>
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<tbody>
<tr>
<td>5</td>
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<td>undergraduate</td>
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<thead>
<tr>
<th>Duration</th>
<th>Contents</th>
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<tr>
<td>1 semester</td>
<td>We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.</td>
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<table>
<thead>
<tr>
<th>Intended learning outcomes</th>
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</thead>
<tbody>
<tr>
<td>The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.</td>
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<table>
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<th>Courses</th>
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<td>(type, number of weekly contact hours, language — if other than German)</td>
<td>(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)</td>
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<tr>
<td>V (2) + Ü (2)</td>
<td>written examination (approx. 60 to 120 minutes).</td>
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<td></td>
<td>If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).</td>
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<tr>
<td></td>
<td>Language of assessment: German and/or English creditable for bonus</td>
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<tr>
<td>Selected Basics of Computer Science</td>
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<tbody>
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<td>Dean of Studies Informatik (Computer Science)</td>
<td>Institute of Computer Science</td>
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<tr>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title | Abbreviation
--- | ---
Advanced Programming | 10-I-APR-172-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | undergraduate | --

Contents
With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

Intended learning outcomes
Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<thead>
<tr>
<th>Module title</th>
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<tr>
<td>Practical course in hardware</td>
<td>10-I-HWP-152-m01</td>
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<td>Institute of Computer Science</td>
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<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

**Intended learning outcomes**

The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
### Contents

The course provides a broad sweep through concepts and technologies related to IT security:

- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

### Intended learning outcomes

Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker view point. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

### Courses (type, number of weekly contact hours, language — if other than German)

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<tr>
<th>Type</th>
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<th>Language</th>
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Module taught in: German and/or English

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- written examination (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
- Language of assessment: German and/or English
- creditable for bonus

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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<table>
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<td>Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.</td>
</tr>
</tbody>
</table>

### Contents

The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

### Intended learning outcomes

The students are able to independently develop small to middle-sized, high-quality Java programs.

### Courses (type, number of weekly contact hours, language — if other than German)

- P (6)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
## Module title

**Project Presentation**

Abbreviation: 10-I-PV-152-m01

### Module coordinator

Dean of Studies Informatik (Computer Science)

### Module offered by

Institute of Computer Science

### ECTS

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### Duration

1 semester

### Method of grading

Numerical grade: --

### Contents

Presentation of a project developed by the student (e.g. Bachelor's thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

### Intended learning outcomes

The students are able to present a project they developed and to create the required media.

### Courses

<table>
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<th>Type</th>
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<th>Language</th>
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### Method of assessment

Presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

German and/or English

Examination regulations for teaching-degree programmes

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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
### Module title
Seminar 2

| Abbreviation | 10-I-SEM2-152-m01 |

### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

### ECTS
5

### Method of grading
Numerical grade

### Duration
1 semester

### Contents
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

### Intended learning outcomes
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

### Courses
S (2)

### Method of assessment
Wrap-up report on tutoring activities (5 to 10 pages)
Language of assessment: German and/or English

### Referred to in LPO I
(examination regulations for teaching-degree programmes)
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<td>Control Principles of Modern</td>
<td>10-I-SKS-191-m01</td>
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<td>Communication Systems</td>
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<td>holder of the Chair of Computer Science III</td>
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### Contents
- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

### Intended learning outcomes
The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

### Courses (type, number of weekly contact hours, language — if other than German)
V (4) + Ü (2)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

### Allocation of places
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### Additional information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title: Practical course in software
Abbreviation: 10-I-SWP-152-m01

Module coordinator: Dean of Studies Informatik (Computer Science)
Module offered by: Institute of Computer Science

ECTS: 10
Method of grading: (not) successfully completed
Only after succ. compl. of module(s): 10-I-PP, 10-I-ST

Duration: 1 semester
Module level: undergraduate
Other prerequisites: In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.

Contents:
Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

Intended learning outcomes:
The students possess the practical skills for the design, development and execution of a software project in small teams.

Courses (type, number of weekly contact hours, language — if other than German):
P (6)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus):
practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

Allocation of places:
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Additional information:
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Referred to in LPO I (examination regulations for teaching-degree programmes):
§ 69 I Nr. 1d
Winter Term 2019
(o ECTS credits)
### Contents

We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

### Intended learning outcomes

The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

### courses

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### Method of assessment

- written examination (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
- Language of assessment: German and/or English creditable for bonus

### Allocation of places

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### Additional information

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### Referred to in LPO I

§ 22 II Nr. 3b
### Selected Basics of Computer Science

<table>
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#### Module coordinator
Dean of Studies Informatik (Computer Science)

#### Module offered by
Institute of Computer Science

#### ECTS | Method of grading | Only after succ. compl. of module(s) |
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<td>1 semester</td>
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#### Contents
Selected topics in computer science.

#### Intended learning outcomes
The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

#### Courses
(type, number of weekly contact hours, language — if other than German)

- V (4) + Ü (2)

#### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- written examination (approx. 60 to 120 minutes).
  If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
  Language of assessment: German and/or English creditable for bonus

#### Allocation of places
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#### Additional information
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#### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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Module title | Abbreviation
---|---
Advanced Programming | 10-I-APR-172-m01

**Module coordinator**
holder of the Chair of Computer Science II

**Module offered by**
Institute of Computer Science

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**Contents**

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler pro-
grams. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and
code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensi-
ble structure. Also, further topics in the areas of software security and parallel programming are dis-
cussed.

**Intended learning outcomes**

Students learn advanced programming paradigms especially suited for space applications. Different patterns are
then implemented in multiple languages and their efficiency measured using standard metrics. In addition, par-
allel processing concepts are introduced culminating in the use of GPU architectures for extremely quick proces-
sing.

**Courses**

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**Method of assessment**

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**Allocation of places**

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**Additional information**

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**Contents**

Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

**Intended learning outcomes**

The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

**Courses**

(type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
### Module title
**IT Security**

### Abbreviation
10-I-SEC-191-m01

### Module coordinator
holder of the Chair of Computer Science II

### Module offered by
Institute of Computer Science

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
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### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
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## Contents
The course provides a broad sweep through concepts and technologies related to IT security:

- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

## Intended learning outcomes
Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker viewpoint. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

## Courses
(type, number of weekly contact hours, language — if other than German)

**V (2) + Ü (2)**

Module taught in: German and/or English

## Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

## Allocation of places
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## Additional information
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## Referred to in LPO I
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**Contents**

The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

**Intended learning outcomes**

The students are able to independently develop small to middle-sized, high-quality Java programs.

**Courses** (type, number of weekly contact hours, language — if other than German)

| P (6) |

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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### Contents

Presentation of a project developed by the student (e.g. Bachelor’s thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

### Intended learning outcomes

The students are able to present a project they developed and to create the required media.

### Courses

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### Method of assessment

Presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science. Language of assessment: German and/or English.

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Control Principles of Modern Communication Systems

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**Module coordinator**

holder of the Chair of Computer Science III

**Module offered by**

Institute of Computer Science

**ECTS**

Method of grading

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**Duration**

Module level

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**Contents**

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** |
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10 | (not) successfully completed | 10-I-PP, 10-I-ST |

**Duration** | **Module level** | **Other prerequisites**
---|---|---
1 semester | undergraduate | In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.

**Contents**

Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

**Intended learning outcomes**

The students possess the practical skills for the design, development and execution of a software project in small teams.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 69 I Nr. 1d
Summer Term 2020

(0 ECTS credits)
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**Contents**

Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

**Intended learning outcomes**

The students possess the practical skills for the design, development and execution of a software project in small teams.

**Courses** (type, number of weekly contact hours, language — if other than German)

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**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

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<th>Language</th>
<th>Examination offered</th>
<th>Module creditable for bonus</th>
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<tr>
<td>Practical project</td>
<td>Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)</td>
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**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 69 I Nr. 1d
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tr>
<td>Control Principles of Modern Communication Systems</td>
<td>10-I-SKS-191-m01</td>
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**Module coordinator**
holder of the Chair of Computer Science III

**Module offered by**
Institute of Computer Science

**ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** |
----------|-----------------------|------------------------------------------|
8         | numerical grade       | --                                       |

**Duration** | **Module level** | **Other prerequisites** |
1 semester   | undergraduate       | --                        |

**Contents**
- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**
The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses** (type, number of weekly contact hours, language — if other than German)
V (4) + Ü (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)
--
## Seminar 2

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<th>Module title</th>
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<tbody>
<tr>
<td>Seminar 2</td>
<td>10-I-SEM2-152-m01</td>
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</table>

### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

### ECTS
5

### Method of grading
Numerical grade

### Method of grading
Only after succ. compl. of module(s)

### Duration
1 semester

### Module level
Undergraduate

### Other prerequisites
--

### Contents
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

### Intended learning outcomes
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

### Courses
(type, number of weekly contact hours, language — if other than German)

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours</th>
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<tbody>
<tr>
<td>S</td>
<td>(2)</td>
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</table>

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)

Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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<table>
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<th>Module title</th>
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**Module coordinator**
Dean of Studies Informatik (Computer Science)

**Module offered by**
Institute of Computer Science

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**Duration**
1 semester

**Module level**
undergraduate

**Other prerequisites**
--

**Contents**
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)
S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science
Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
Module title: Project Presentation
Abbreviation: 10-I-PV-152-m01

Module coordinator:Dean of Studies Informatik (Computer Science)
Module offered by:Institute of Computer Science

ECTS: 5
Method of grading: numerical grade
Duration: 1 semester
Module level: undergraduate

Other prerequisites:

Contents:
Presentation of a project developed by the student (e.g. Bachelor's thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

Intended learning outcomes:
The students are able to present a project they developed and to create the required media.

Courses:
S (5)

Method of assessment:
Presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)
Language of assessment: German and/or English

Allocation of places:
--

Additional information:
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Referred to in LPO I (examination regulations for teaching-degree programmes):
§ 22 II Nr. 3b
## Module title
Practical Course in Programming

## Abbreviation
10-I-PP-191-m01

### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

### ECTS
10

### Method of grading
Only after succ. compl. of module(s)

### Duration
undergraduate

### Module level
Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.

### Other prerequisites
--

## Contents
The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

## Intended learning outcomes
The students are able to independently develop small to middle-sized, high-quality Java programs.

## Courses
(type, number of weekly contact hours, language — if other than German)
P (6)

## Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

## Allocation of places
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## Additional information
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## Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
**Module title**

IT Security

**Abbreviation**

10-I-SEC-191-m01

**Module coordinator**

holder of the Chair of Computer Science II

**Module offered by**

Institute of Computer Science

**ECTS**

5

**Method of grading**

Only after succ. compl. of module(s)

**Numerical grade**

--

**Duration**

1 semester

**Module level**

undergraduate

**Other prerequisites**

--

**Contents**

The course provides a broad sweep through concepts and technologies related to IT security:

- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

**Intended learning outcomes**

Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker view point. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

Module taught in: German and/or English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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<table>
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<th>Abbreviation</th>
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<td>Practical course in hardware</td>
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**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

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<th>Module level</th>
<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

**Intended learning outcomes**

The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

**Courses**

(type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
Module title: Advanced Programming
Abbreviation: 10-I-APR-172-m01

Module coordinator: holder of the Chair of Computer Science II
Module offered by: Institute of Computer Science

ECTS: 5
Method of grading: numerical grade
Only after succ. compl. of module(s)

Duration: 1 semester
Module level: undergraduate
Other prerequisites: --

Contents
With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

Intended learning outcomes
Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title
Selected Basics of Computer Science

Abbreviation
10-I-GI-152-m01

Module coordinator
Dean of Studies Informatik (Computer Science)

Module offered by
Institute of Computer Science

ECTS
5

Method of grading
numerical grade

Only after succ. compl. of module(s)

Duration
1 semester

Module level
undergraduate

Other prerequisites

Contents
Selected topics in computer science.

Intended learning outcomes
The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

Courses
(type, number of weekly contact hours, language — if other than German)
V (4) + Ü (2)

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
**Algorithmic Graph Theory**

**Abbreviation**

10-I-AGT-152-m01

<table>
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<th><strong>Module coordinator</strong></th>
<th><strong>Module offered by</strong></th>
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<tbody>
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<td>holder of the Chair of Computer Science I</td>
<td>Institute of Computer Science</td>
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<th><strong>Module level</strong></th>
<th><strong>Other prerequisites</strong></th>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</tbody>
</table>

**Contents**

We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

**Intended learning outcomes**

The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
Winter Term 2020
(0 ECTS credits)
Module title: Algorithmic Graph Theory

Abbreviation: 10-I-AGT-152-m01

Module coordinator: holder of the Chair of Computer Science I

Module offered by: Institute of Computer Science

ECTS: 5

Method of grading: numerical grade

Duration: 1 semester

Module level: undergraduate

Other prerequisites: --

Contents:
We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

Intended learning outcomes:
The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

Courses (type, number of weekly contact hours, language — if other than German):
V (2) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus):
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places:
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Additional information:
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Referred to in LPO I (examination regulations for teaching-degree programmes):
§ 22 II Nr. 3b
### Module Catalogue for the Module studies (Bachelor)
#### Computer Science

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<td>Selected Basics of Computer Science</td>
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**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

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<th>ECTS</th>
<th>Method of grading</th>
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</table>

**Duration**

1 semester

**Module level**

undergraduate

**Other prerequisites**

--

**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- written examination (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
- Language of assessment: German and/or English creditable for bonus

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title: Advanced Programming  

Abbreviation: 10-I-APR-172-m01

Module coordinator: holder of the Chair of Computer Science II

Module offered by: Institute of Computer Science

ECTS: 5

Method of grading: numerical grade

Only after succ. compl. of module(s)

Duration: 1 semester

Module level: undergraduate

Other prerequisites: --

Contents:

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and codes a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

Intended learning outcomes:

Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

Courses (type, number of weekly contact hours, language — if other than German):

V (2) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus):

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

Allocation of places:

--

Additional information:

--

Referred to in LPO I (examination regulations for teaching-degree programmes):

--
**Module title** | **Abbreviation**
---|---
Practical course in hardware | 10-I-HWP-152-m01

**Module coordinator**
Dean of Studies Informatik (Computer Science)

**Module offered by**
Institute of Computer Science

<table>
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<th>Other prerequisites</th>
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</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**
Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

**Intended learning outcomes**
The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

**Courses**
(type, number of weekly contact hours, language — if other than German)
P (6)

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I**
(examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
Module title | Abbreviation
--- | ---
IT Security | 10-I-SEC-191-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
5 | numerical grade | --

Duration | Module level | Other prerequisites
1 semester | undergraduate | --

Contents
The course provides a broad sweep through concepts and technologies related to IT security:
- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

Intended learning outcomes
Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker viewpoint. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)
Module taught in: German and/or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<td>10-I-LRLA-172-m01</td>
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<td>Institute of Computer Science</td>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

### Contents
Structure and control of satellites and airplanes, control and (very little) regulation of physical/mechanical systems, sensors and actuators, energy, structure (construction) of a satellite model/simulator, construction of a ground segment for different components and systems of air and space flight, structure of simplified subsystems of air and space flight. Life cycle of a complex development consisting of software, hardware, electronics and mechanics. Selection of suitable components.

### Intended learning outcomes
The students will be able to construct and integrate prototypical subsystems consisting of software, hardware, electronics and mechanics by themselves as well as to operate, test and document these. The whole life cycle of a development will be tested: capture of requirements, rudimentary design, detailed design, modelling, implementation (software, hardware, mechanics), test design, inspection, maintenance, transfer to the successor model.

### Courses
(type, number of weekly contact hours, language — if other than German)

V (2) + P (2)

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Completion of approx. 6 practical exercises (approx. 4 hours each)

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)
--
Module title: Practical work Space Technology

Abbreviation: 10-I-PLR-172-m01

Module coordinator: Dean of Studies Informatik (Computer Science)

Module offered by: Institute of Computer Science

ECTS: 4

Method of grading: Only after succ. compl. of module(s)

Duration: 1 semester

Module level: undergraduate

Other prerequisites: --

Contents
Completion of a practical task.

Intended learning outcomes
The practical allows participants to work on a problem in space information technology in teams.

Courses (type, number of weekly contact hours, language — if other than German)
P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

report (5 to 10 pages) and presentation (approx. 15 minutes) on practical work

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module title: Practical Course in Programming
Abbreviation: 10-I-PP-191-m01

Module coordinator: Dean of Studies Informatik (Computer Science)
Module offered by: Institute of Computer Science

ECTS: 10
Method of grading: Only after succ. compl. of module(s)
Duration: (not) successfully completed
Module level: undergraduate
Other prerequisites: Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.

Contents:
The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

Intended learning outcomes:
The students are able to independently develop small to middle-sized, high-quality Java programs.

Courses:
(type, number of weekly contact hours, language — if other than German)
P (6)

Method of assessment:
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Allocation of places:
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Additional information:
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Referred to in LPO I (examination regulations for teaching-degree programmes):
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<table>
<thead>
<tr>
<th>Module title</th>
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<tbody>
<tr>
<td>Project Presentation</td>
<td>10-I-PV-152-m01</td>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Presentation of a project developed by the student (e.g. Bachelor’s thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

**Intended learning outcomes**

The students are able to present a project they developed and to create the required media.

**Courses** (type, number of weekly contact hours, language — if other than German)

$S$ (5)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
### Module Catalogue for the Module studies (Bachelor)
#### Computer Science

<table>
<thead>
<tr>
<th>Module title</th>
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<td>Seminar 1</td>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses**

(type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
<table>
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<td>undergraduate</td>
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
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<td>1 semester</td>
<td>undergraduate</td>
<td>In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.</td>
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</table>

**Contents**

Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

**Intended learning outcomes**

The students possess the practical skills for the design, development and execution of a software project in small teams.

**Courses** *(type, number of weekly contact hours, language — if other than German)*

P (6)

**Method of assessment** *(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)*

practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** *(examination regulations for teaching-degree programmes)*

§ 69 I Nr. 1d
**Module title**  
Control Principles of Modern Communication Systems

**Abbreviation**  
10-I-SKS-191-m01

**Module coordinator**  
holder of the Chair of Computer Science III

**Module offered by**  
Institute of Computer Science

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**Duration**  
1 semester

**Module level**  
undergraduate

**Other prerequisites**  
--

**Contents**

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses** (type, number of weekly contact hours, language — if other than German)

| V (4) + Ü (2) |

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**  
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**Additional information**  
--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Summer Term 2021
(o ECTS credits)
## Algorithmic Graph Theory

### Module title
Algorithmic Graph Theory

### Abbreviation
10-I-AGT-152-m01

### Module coordinator
holder of the Chair of Computer Science I

### Module offered by
Institute of Computer Science

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

### Intended learning outcomes
The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

### Courses
(type, number of weekly contact hours, language — if other than German)

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<tr>
<th>Type</th>
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### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

- written examination (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
- Language of assessment: German and/or English creditable for bonus

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<td>Selected Basics of Computer Science</td>
<td>10-I-GI-152-m01</td>
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### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

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### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
Selected topics in computer science.

### Intended learning outcomes
The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

### Courses
(type, number of weekly contact hours, language — if other than German)

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### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Advanced Programming | 10-I-APR-172-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
5 | numerical grade | --

Duration | Module level | Other prerequisites
1 semester | undergraduate | --

Contents

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

Intended learning outcomes

Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module title | Practical course in hardware
---|---
Abbreviation | 10-I-HWP-152-m01

Module coordinator | Dean of Studies Informatik (Computer Science)
Module offered by | Institute of Computer Science

ECTS | 10
Method of grading | Only after succ. compl. of module(s)
10 | (not) successfully completed
Duration | 1 semester
Module level | undergraduate
Other prerequisites | --

Contents
Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

Intended learning outcomes
The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

Courses (type, number of weekly contact hours, language — if other than German)
P (6)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
### Module title
IT Security

### Abbreviation
10-I-SEC-191-m01

### Module coordinator
holder of the Chair of Computer Science II

### Module offered by
Institute of Computer Science

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
The course provides a broad sweep through concepts and technologies related to IT security:
- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

### Intended learning outcomes
Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker viewpoint. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

### Courses
(V (2) + Ü (2)
Module taught in: German and/or English

### Method of assessment
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English
creditable for bonus

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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<table>
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<th>Abbreviation</th>
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<td>Aerospace Laboratory</td>
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<td>holder of the Chair of Computer Science VIII</td>
<td>Institute of Computer Science</td>
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<th>Other prerequisites</th>
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<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Structure and control of satellites and airplanes, control and (very little) regulation of physical/mechanical systems, sensors and actuators, energy, structure (construction) of a satellite model/simulator, construction of a ground segment for different components and systems of air and space flight, structure of simplified subsystems of air and space flight. Life cycle of a complex development consisting of software, hardware, electronics and mechanics. Selection of suitable components.

**Intended learning outcomes**

The students will be able to construct and integrate prototypical subsystems consisting of software, hardware, electronics and mechanics by themselves as well as to operate, test and document these. The whole life cycle of a development will be tested: capture of requirements, rudimentary design, detailed design, modelling, implementation (software, hardware, mechanics), test design, inspection, maintenance, transfer to the successor model.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + P (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Completion of approx. 6 practical exercises (approx. 4 hours each)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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<table>
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<tr>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Practical experiments of control aspects (hardware and software), for example implementation of linear and non-linear controllers in robotics or aerospace information technology.

**Intended learning outcomes**

Students understand closed loop systems and are able to implement and set controllers.

**Courses** (type, number of weekly contact hours, language — if other than German)

| P | 6 |

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Project with presentation (approx. 15 minutes) and written elaboration (approx. 12 to 15 pages)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
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<td>undergraduate</td>
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### Contents

Completion of a practical task.

### Intended learning outcomes

The practical allows participants to work on a problem in space information technology in teams.

### Courses

(type, number of weekly contact hours, language — if other than German)

P (2)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

report (5 to 10 pages) and presentation (approx. 15 minutes) on practical work

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
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**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

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**Duration**

undergraduate

**Other prerequisites**

Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.

**Contents**

The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

**Intended learning outcomes**

The students are able to independently develop small to middle-sized, high-quality Java programs.

**Courses**

(type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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Module title | Abbreviation
--- | ---
Project Presentation | 10-l-PV-152-m01

Module coordinator | Module offered by
--- | ---
Dean of Studies Informatik (Computer Science) | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | undergraduate | --

Contents
Presentation of a project developed by the student (e.g. Bachelor's thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

Intended learning outcomes
The students are able to present a project they developed and to create the required media.

Courses (type, number of weekly contact hours, language — if other than German)
S (5)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)
Language of assessment: German and/or English

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
### Module title

**Seminar 1**

### Abbreviation

10-I-SEM1-152-m01

### Module coordinator

Dean of Studies Informatik (Computer Science)

### Module offered by

Institute of Computer Science

### ECTS

5

### Method of grading

numerical grade

### Only after succ. compl. of module(s)

--

### Duration

1 semester

### Module level

undergraduate

### Other prerequisites

--

### Contents

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

### Intended learning outcomes

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

### Courses

(type, number of weekly contact hours, language — if other than German)

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### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science

Language of assessment: German and/or English

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
Module title | Abbreviation
--- | ---
Seminar 2 | 10-I-SEM2-152-m01

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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title | Practical course in software
---|---
Abbreviation | 10-I-SWP-152-m01

Module coordinator | Dean of Studies Informatik (Computer Science)
Module offered by | Institute of Computer Science

ECTS | 10
Method of grading | Only after succ. compl. of module(s)

Duration | 1 semester
Module level | undergraduate
Other prerequisites | In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.

Contents
Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

Intended learning outcomes
The students possess the practical skills for the design, development and execution of a software project in small teams.

Courses
(type, number of weekly contact hours, language — if other than German)

P (6)

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 69 I Nr. 1d
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**Contents**

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Winter Term 2021
(o ECTS credits)
Module title | Algorithmic Graph Theory | 10-I-AGT-152-m01
---|---|---
Module coordinator | holder of the Chair of Computer Science I | Institute of Computer Science
ECTS | 5 | numerical grade
Method of grading | Only after succ. compl. of module(s) |
Duration | 1 semester | undergraduate
Module level | Other prerequisites |
Contents
We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

Intended learning outcomes
The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

Courses
(type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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### Contents

Selected topics in computer science.

### Intended learning outcomes

The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

### Courses

(type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

### Allocation of places

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### Additional information

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### Referred to in LPO 1

(examination regulations for teaching-degree programmes)

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### Module title

**Advanced Programming**

### Abbreviation

10-I-APR-172-m01

### Module coordinator

holder of the Chair of Computer Science II

### Module offered by

Institute of Computer Science

### ECTS

5

### Method of grading

numerical grade

### Only after succ. compl. of module(s)

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### Duration

1 semester

### Module level

undergraduate

### Other prerequisites

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### Contents

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

### Intended learning outcomes

Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

### Courses

(type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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**Contents**
Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

**Intended learning outcomes**
The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)

**Allocation of places**
--

**Additional information**
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
Module title | Abbreviation
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IT Security | 10-I-SEC-191-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

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Duration | Module level | Other prerequisites
1 semester | undergraduate | -- |

Contents
The course provides a broad sweep through concepts and technologies related to IT security:
- **Theoretical aspects:** information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- **Network security:** protocol security, security of TCP/IP, public key infrastructure, user authentication
- **Software security:** Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- **Platform security:** access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

Intended learning outcomes
Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker viewpoint. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)
Module taught in: German and/or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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**Contents**

Structure and control of satellites and airplanes, control and (very little) regulation of physical/mechanical systems, sensors and actuators, energy, structure (construction) of a satellite model/simulator, construction of a ground segment for different components and systems of air and space flight, structure of simplified subsystems of air and space flight. Life cycle of a complex development consisting of software, hardware, electronics and mechanics. Selection of suitable components.

**Intended learning outcomes**

The students will be able to construct and integrate prototypical subsystems consisting of software, hardware, electronics and mechanics by themselves as well as to operate, test and document these. The whole life cycle of a development will be tested: capture of requirements, rudimentary design, detailed design, modelling, implementation (software, hardware, mechanics), test design, inspection, maintenance, transfer to the successor model.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2) + P (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Completion of approx. 6 practical exercises (approx. 4 hours each)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

Practical experiments of control aspects (hardware and software), for example implementation of linear and non-linear controllers in robotics or aerospace information technology.

**Intended learning outcomes**

Students understand closed loop systems and are able to implement and set controllers.

**Courses**

(type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project with presentation (approx. 15 minutes) and written elaboration (approx. 12 to 15 pages)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Completion of a practical task.

**Intended learning outcomes**

The practical allows participants to work on a problem in space information technology in teams.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

report (5 to 10 pages) and presentation (approx. 15 minutes) on practical work

**Allocation of places**

--

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tr>
<td>Practical Course in Programming</td>
<td>10-I-PP-191-m01</td>
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<td>Dean of Studies Informatik (Computer Science)</td>
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<tr>
<td></td>
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<td>Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.</td>
</tr>
</tbody>
</table>

**Contents**

The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

**Intended learning outcomes**

The students are able to independently develop small to middle-sized, high-quality Java programs.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**

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**Additional information**

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**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

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### Module title
Project Presentation

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<td>10-I-PV-152-m01</td>
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### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

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### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
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### Contents
Presentation of a project developed by the student (e.g. Bachelor's thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

### Intended learning outcomes
The students are able to present a project they developed and to create the required media.

### Courses
5 (S)

### Method of assessment
presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)
Language of assessment: German and/or English

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
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<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
<table>
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<th>Module title</th>
<th>Abbreviation</th>
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<tr>
<td>Seminar 2</td>
<td>10-I-SEM2-152-m01</td>
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**Module coordinator**

Dean of Studies Informatik (Computer Science)

**Module offered by**

Institute of Computer Science

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**Duration**

1 semester    

**Module level**

undergraduate

**Other prerequisites**

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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<table>
<thead>
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<th>Other prerequisites</th>
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<td>1 semester</td>
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<td>In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.</td>
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</table>

**Contents**

Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

**Intended learning outcomes**

The students possess the practical skills for the design, development and execution of a software project in small teams.

**Courses** (type, number of weekly contact hours, language — if other than German)

| P | 6 |

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 69 I Nr. 1d
<table>
<thead>
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<th>Module title</th>
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<td>Control Principles of Modern Communication Systems</td>
<td>10-I-SKS-191-m01</td>
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<td>1 semester</td>
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</table>

**Contents**

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses** (type, number of weekly contact hours, language — if other than German)

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<thead>
<tr>
<th>Type (V)</th>
<th>Contact hours</th>
<th>Language</th>
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<tr>
<td>V (4)</td>
<td>+ Ü (2)</td>
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**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Summer Term 2022
(0 ECTS credits)
Module title
Algorithmic Graph Theory
Abbreviation
10-I-AGT-152-m01

Module coordinator
holder of the Chair of Computer Science I

Module offered by
Institute of Computer Science

ECTS
5

Method of grading
numerical grade

Only after succ. compl. of module(s)
--

Duration
1 semester

Module level
undergraduate

Other prerequisites
--

Contents
We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

Intended learning outcomes
The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

Courses
(type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)

Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English
credible for bonus

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
<table>
<thead>
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<tr>
<td>Selected Basics of Computer Science</td>
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### Module coordinator
Dean of Studies Informatik (Computer Science)

### Module offered by
Institute of Computer Science

### ECTS | Method of grading | Only after succ. compl. of module(s) |
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### Duration | Module level | Other prerequisites |
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<tr>
<td>1 semester</td>
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</table>

### Contents
Selected topics in computer science.

### Intended learning outcomes
The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

### Courses
(type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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Module title | Abbreviation
--- | ---
Advanced Programming | 10-I-APR-172-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | undergraduate | --

Contents

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

Intended learning outcomes

Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

Courses (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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## Module title

**Practical course in hardware**

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<tr>
<th>Abbreviation</th>
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## Module coordinator

Dean of Studies Informatik (Computer Science)

## Module offered by

Institute of Computer Science

## ECTS

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## Duration

1 semester

## Module level

undergraduate

## Other prerequisites

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## Contents

Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

## Intended learning outcomes

The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

## Courses

<table>
<thead>
<tr>
<th>type, number of weekly contact hours, language — if other than German</th>
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## Method of assessment

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<tbody>
<tr>
<td>portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)</td>
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</table>

## Allocation of places

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## Additional information

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## Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
Module title | Abbreviation
---|---
IT Security | 10-I-SEC-191-m01

Module coordinator | Module offered by
holder of the Chair of Computer Science II | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
---|---|---
5 | numerical grade | --

Duration | Module level | Other prerequisites
---|---|---
1 semester | undergraduate | --

Contents
The course provides a broad sweep through concepts and technologies related to IT security:

- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

Intended learning outcomes
Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker viewpoint. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + Ü (2)
Module taught in: German and/or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<table>
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<td>Aerospace Laboratory</td>
<td>10-I-LRLA-172-m01</td>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Structure and control of satellites and airplanes, control and (very little) regulation of physical/mechanical systems, sensors and actuators, energy, structure (construction) of a satellite model/simulator, construction of a ground segment for different components and systems of air and space flight, structure of simplified subsystems of air and space flight. Life cycle of a complex development consisting of software, hardware, electronics and mechanics. Selection of suitable components.

**Intended learning outcomes**

The students will be able to construct and integrate prototypical subsystems consisting of software, hardware, electronics and mechanics by themselves as well as to operate, test and document these. The whole life cycle of a development will be tested: capture of requirements, rudimentary design, detailed design, modelling, implementation (software, hardware, mechanics), test design, inspection, maintenance, transfer to the successor model.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + P (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Completion of approx. 6 practical exercises (approx. 4 hours each)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
**Module title**
Practical Measurement and Control System Engineering

**Abbreviation**
10-I-HMR-152-m01

**Module coordinator**
holder of the Chair of Computer Science VI

**Module offered by**
Institute of Computer Science

**ECTS**
8

**Method of grading**
(only) successfully completed

**Duration**
1 semester

**Module level**
undergraduate

**Other prerequisites**
--

**Contents**
Practical experiments of control aspects (hardware and software), for example implementation of linear and non-linear controllers in robotics or aerospace information technology.

**Intended learning outcomes**
Students understand closed loop systems and are able to implement and set controllers.

**Courses**
(type, number of weekly contact hours, language — if other than German)

**P (6)**

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project with presentation (approx. 15 minutes) and written elaboration (approx. 12 to 15 pages)

**Allocation of places**
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**Additional information**
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**Referred to in LPO I**
(examination regulations for teaching-degree programmes)

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<table>
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<td>Practical work Space Technology</td>
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**Module coordinator**

- Dean of Studies Informatik (Computer Science)

**Module offered by**

- Institute of Computer Science

**ECTS**

- 4

**Method of grading**

- Only after succ. compl. of module(s)

**Duration**

- 1 semester

**Module level**

- undergraduate

**Other prerequisites**

- --

**Contents**

- Completion of a practical task.

**Intended learning outcomes**

- The practical allows participants to work on a problem in space information technology in teams.

**Courses**

- P (2)

**Method of assessment**

- Report (5 to 10 pages) and presentation (approx. 15 minutes) on practical work

**Allocation of places**

- --

**Additional information**

- --

**Referred to in LPO I**

- (examination regulations for teaching-degree programmes)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Practical Course in Programming</td>
<td>10-I-PP-191-m01</td>
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<td>Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.</td>
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</table>

**Contents**

The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

**Intended learning outcomes**

The students are able to independently develop small to middle-sized, high-quality Java programs.

**Courses**

(type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

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<table>
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<td>Project Presentation</td>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**

Presentation of a project developed by the student (e.g. Bachelor’s thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

**Intended learning outcomes**

The students are able to present a project they developed and to create the required media.

**Courses** (type, number of weekly contact hours, language — if other than German)

| S (5) |

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
Module title | Abbreviation
--- | ---
Seminar 1 | 10-I-SEM1-152-m01

Module coordinator | Module offered by
Dean of Studies Informatik (Computer Science) | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
5 | numerical grade | --

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | undergraduate | --

Contents
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

Intended learning outcomes
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science
Language of assessment: German and/or English

Allocation of places
--

Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
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<td>Seminar 2</td>
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**Module coordinator**  
Dean of Studies Informatik (Computer Science)  
Institute of Computer Science

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**Duration**  
1 semester  
undergraduate  
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)  
Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title | Abbreviation
--- | ---
Practical course in software | 10-I-SWP-152-m01

Module coordinator | Module offered by
--- | ---
Dean of Studies Informatik (Computer Science) | Institute of Computer Science

ECTS | Method of grading | Only after succ. compl. of module(s)
10 | (not) successfully completed | 10-I-PP, 10-I-ST

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | undergraduate | In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.

Contents
Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

Intended learning outcomes
The students possess the practical skills for the design, development and execution of a software project in small teams.

Courses (type, number of weekly contact hours, language — if other than German)
P (6)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 69 I Nr. 1d
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<td>Control Principles of Modern Communication Systems</td>
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</table>

**Contents**

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Winter Term 2022

(0 ECTS credits)
## Algorithmic Graph Theory

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<td>Algorithmic Graph Theory</td>
<td>10-I-AGT-152-m01</td>
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### Contents

We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.

### Intended learning outcomes

The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.

### Courses

<table>
<thead>
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<tr>
<td>V (2) + Ü (2)</td>
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### Method of assessment

- **Written examination** (approx. 60 to 120 minutes).
- If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
- Language of assessment: German and/or English creditable for bonus

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

- § 22 II Nr. 3b
<table>
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<td>Selected Basics of Computer Science</td>
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</table>

**Contents**

Selected topics in computer science.

**Intended learning outcomes**

The students are able to understand solutions to fundamental problems in computer science and to transfer them to related topics.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).
Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<td>Advanced Programming</td>
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**Contents**

With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.

**Intended learning outcomes**

Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Contents**

Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.

**Intended learning outcomes**

The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

<table>
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<th>Portfolio</th>
<th>completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)</th>
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**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
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**Contents**

The course provides a broad sweep through concepts and technologies related to IT security:

- Theoretical aspects: information-theoretic security, computational security, introduction to cryptography (historical and modern ciphers, hash functions, pseudo-random generators, message authentication codes, public key cryptography)
- Network security: protocol security, security of TCP/IP, public key infrastructure, user authentication
- Software security: Software vulnerabilities, common programming errors and exploitation techniques, reverse engineering and obfuscation, malware and anti-malware
- Platform security: access control models, security policies, operating system security, virtualization, security mechanisms with support in hardware

**Intended learning outcomes**

Students will be introduced to the main concepts and abstractions of IT security. They learn how to model threats and analyze security of a system critically from the attacker view point. After visiting the lecture students are going to understand the purpose and function of several security technologies, as well as their limitations. The exercises provide some hands-on experience of security flows in software.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (2) + Ü (2)

Module taught in: German and/or English

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English

creditable for bonus

**Allocation of places**

--

**Additional information**

--

**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title: Aerospace Laboratory
Abbreviation: 10-I-LRLA-172-m01

Module coordinator: holder of the Chair of Computer Science VIII
Module offered by: Institute of Computer Science

ECTS: 6
Method of grading: numerical grade
Duration: 1 semester
Module level: undergraduate
Other prerequisites: --

Contents
Structure and control of satellites and airplanes, control and (very little) regulation of physical/mechanical systems, sensors and actuators, energy, structure (construction) of a satellite model/simulator, construction of a ground segment for different components and systems of air and space flight, structure of simplified subsystems of air and space flight. Life cycle of a complex development consisting of software, hardware, electronics and mechanics. Selection of suitable components.

Intended learning outcomes
The students will be able to construct and integrate prototypical subsystems consisting of software, hardware, electronics and mechanics by themselves as well as to operate, test and document these. The whole life cycle of a development will be tested: capture of requirements, rudimentary design, detailed design, modelling, implementation (software, hardware, mechanics), test design, inspection, maintenance, transfer to the successor model.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
Completion of approx. 6 practical exercises (approx. 4 hours each)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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### Contents

Practical experiments of control aspects (hardware and software), for example implementation of linear and non-linear controllers in robotics or aerospace information technology.

### Intended learning outcomes

Students understand closed loop systems and are able to implement and set controllers.

### Courses

(type, number of weekly contact hours, language — if other than German)

**P (6)**

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project with presentation (approx. 15 minutes) and written elaboration (approx. 12 to 15 pages)

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
<th>Module title</th>
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<tr>
<td>Practical work Space Technology</td>
<td>10-I-PLR-172-m01</td>
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<td>Dean of Studies Informatik (Computer Science)</td>
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### Contents

Completion of a practical task.

### Intended learning outcomes

The practical allows participants to work on a problem in space information technology in teams.

### Courses

P (2)

### Method of assessment

Report (5 to 10 pages) and presentation (approx. 15 minutes) on practical work

### Allocation of places

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### Additional information

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### Referred to in LPO I

(examination regulations for teaching-degree programmes)

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**Module title** | **Abbreviation**
--- | ---
Practical Course in Programming | 10-I-PP-191-m01

| Module coordinator | Module offered by |
--- | ---
Dean of Studies Informatik (Computer Science) | Institute of Computer Science

| ECTS | Method of grading | Only after succ. compl. of module(s) |
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10 | (not) successfully completed | --

| Duration | Module level | Other prerequisites |
--- | --- | ---
undergraduate | Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.

**Contents**
The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

**Intended learning outcomes**
The students are able to independently develop small to middle-sized, high-quality Java programs.

**Courses**
(type, number of weekly contact hours, language — if other than German)
P (6)

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
practical examination (programming exercises, approx. 240 hours) and written examination (approx. 60 to 120 minutes).
If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

**Allocation of places**
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**Additional information**
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<table>
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<tr>
<td>Project Presentation</td>
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**Module coordinator**  
Dean of Studies Informatik (Computer Science)

**Module offered by**  
Institute of Computer Science

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**Duration**  
1 semester

**Module level**  
undergraduate

**Other prerequisites**  
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**Contents**
Presentation of a project developed by the student (e.g. Bachelor’s thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.

**Intended learning outcomes**
The students are able to present a project they developed and to create the required media.

**Courses**  
(S (5))

**Method of assessment**
Presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total)
Language of assessment: German and/or English

**Allocation of places**  
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**Additional information**  
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3b
<table>
<thead>
<tr>
<th>Module title</th>
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<tr>
<td>Seminar 1</td>
<td>10-I-SEM1-152-m01</td>
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**Contents**

Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**

The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses** (type, number of weekly contact hours, language — if other than German)

$S$ (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science

Language of assessment: German and/or English

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3b
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<tr>
<td>Seminar 2</td>
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**Module coordinator**
Dean of Studies Informatik (Computer Science)

**Module offered by**
Institute of Computer Science

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**Contents**
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).

**Intended learning outcomes**
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.

**Courses**
(type, number of weekly contact hours, language — if other than German)

S (2)

**Method of assessment**
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Wrap-up report on tutoring activities (5 to 10 pages)
Language of assessment: German and/or English

**Allocation of places**
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**Additional information**
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<table>
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<td>In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.</td>
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</table>

**Contents**

Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e.g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

**Intended learning outcomes**

The students possess the practical skills for the design, development and execution of a software project in small teams.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (6)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical project (Completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

§ 69 I Nr. 1d
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<td>Control Principles of Modern Communication Systems</td>
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<tr>
<td>holder of the Chair of Computer Science III</td>
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**Contents**

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

**Intended learning outcomes**

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 60 to 120 minutes).

If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).

Language of assessment: German and/or English creditable for bonus

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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