



## **Module description**

### **Bachelor in Computer Science, PO Version of 2015 (WT)**

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## Module BIN-100 Mathematics 1

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-MAT1)   |
| <b>Level of Module</b>                         | Basic module   |
| <b>Type of Module</b>                          | Compulsory module  |
| <b>Submodules</b>                              | BIN-100-01 Mathematics 1, Compulsory   |
| <b>Person in Charge</b>                        | Sprengel, Frauke, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 1  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | none   |
| <b>Recommended Prerequisites</b>               | none   |
| <b>Examination</b>                             | Examination (written or oral examination) and work on tasks as experimental work |

### Learning Outcomes

Formal skills: Knowledge of logics and familiarization with mathematical formalisms to describe facts

Algorithmic skills: Getting to know algorithms and their complexity

Mathematical skills: Selection and implementation of suitable solutions for elementary problems in mathematics and computer science

Interdisciplinary skills: Communicative skills (presentation and discussion of solution proposals)

## Submodule BIN-100-01 Mathematics 1

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-MAT1)   |
| <b>Person in Charge</b>                        | Sprengel, Frauke, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 1  |
| <b>Suggestions for Independent Study</b>       | see literature   |
| <b>Recommended Prerequisites</b>               | none   |
| <b>Examination</b>                             | Examination (written or oral examination) and work on tasks as experimental work |

### Learning Outcomes

Formal skills: Knowledge of logics and familiarization with mathematical formalisms to describe facts

Algorithmic skills: Getting to know algorithms and their complexity

Mathematical skills: Selection and implementation of suitable solutions for elementary problems in mathematics and computer science

Interdisciplinary skills: Communicative skills (presentation and discussion of solution proposals)

### Content

The basic principles taught in higher mathematics include topics in the following fields:

- Logics, Boolean algebra
- Set theory
- Number systems
- Functions and relations
- Graph theory
- Elementary number theory The corresponding standard software is used to illustrate terms and processes.

### Requirements for Contact Hours

Active participation, individual task-solving, discussion

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature, individual task-solving, assessment of the solutions, individual discussion

### Bibliography

Lecture notes

Teschl, G., Teschl, S.: Mathematik für Informatiker, Springer - Verlag

Hartmann, P.: Mathematik für Informatiker, Vieweg - Verlag

## Module BIN-101 Start Project

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-STP)  |
| <b>Level of Module</b>                         | Basic module   |
| <b>Type of Module</b>                          | Compulsory module                                    |
| <b>Submodules</b>                              | BIN-101-01 Start Project, Compulsory                 |
| <b>Person in Charge</b>                        | Garmann, Robert, Prof. Dr.                           |
| <b>ECTS Credits</b>                            | 4  |
| <b>Contact Hours / Independent Study Hours</b> | 90 h / 30 h  |
| <b>Semester</b>                                | 1  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | none   |
| <b>Recommended Prerequisites</b>               | none   |
| <b>Examination</b>                             | Examination (written or oral ) and experimental work |

### Learning Outcomes

Personal skills: The students identify successful strategies of self-organization, self-initiative, research and knowledge acquisition

Social skills: The students have tried teamwork and know the importance of communication and presentation skills for project success.

Project management skills: The students know simple methods for project planning and project control and can apply them in a small project.

Professional skills: The students are familiar with the large number of applications of the discipline computer science. They are able to purposefully debate, analyze and discuss a specific problem and can develop a solution over several weeks.

## Submodule BIN-101-01 Start Project

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-STP)  |
| <b>Person in Charge</b>                        | Garmann, Robert, Prof. Dr.                           |
| <b>Language of Instruction</b>                 | German   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Project, 4 SWS                                       |
| <b>ECTS Credits</b>                            | 4  |
| <b>Contact Hours / Independent Study Hours</b> | 90 h / 30 h  |
| <b>Semester</b>                                | 1  |
| <b>Suggestions for Independent Study</b>       | Specific to project                                  |
| <b>Recommended Prerequisites</b>               | none   |
| <b>Examination</b>                             | Examination (written or oral ) and experimental work |

### Learning Outcomes

Personal skills: The students identify successful strategies of self-organization, self-initiative, research and knowledge acquisition

Social skills: The students have tried teamwork and know the importance of communication and presentation skills for project success.

Project management skills: The students know simple methods for project planning and project control and can apply them in a small project.

Professional skills: The students are familiar with the large number of applications of the discipline computer science. They are able to purposefully debate, analyze and discuss a specific problem and can develop a solution over several weeks.

### Content

Working on a problem and developing its solution in a given topic such as game development, robotics, algorithms. Trying out methods that are taught during individual coaching talks in the project's context.

### Requirements for Contact Hours

Active, self-responsible development of project results. Active participation in project planning and organization, in introductory workshops and team meetings. Presentation and discussion of results.

### Requirements for Independent Study Hours

Active development of project results. Preparation and follow-up of team meetings.

### Bibliography

Specific to project

## Module BIN-102 Programming 1

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-PR1)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-102-01 Programming 1, Compulsory                            |
| <b>Person in Charge</b>                        | Garmann, Robert, Prof. Dr.                                      |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 1   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | none  |
| <b>Recommended Prerequisites</b>               | none  |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Algorithmic skills: analyze a given problem and solve it algorithmically, use basic algorithms and data structures to solve problems

Realization skills: mastering the imperative programming paradigm while using object libraries, creating and testing programs using appropriate tools



## Submodule BIN-102-01 Programming 1

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-PR1)   |
| <b>Person in Charge</b>                        | Garmann, Robert, Prof. Dr.                                      |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 1   |
| <b>Suggestions for Independent Study</b>       | see literature  |
| <b>Recommended Prerequisites</b>               | none  |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Algorithmic skills: analyze a given problem and solve it algorithmically, use basic algorithms and data structures to solve problems

Realization skills: mastering the imperative programming paradigm while using object libraries, creating and testing programs using appropriate tools

### Content

Introduction to the basic principles of object-oriented programming using the Java programming language, whose language constructs are presented with a number of important libraries. Many practical examples provide more insight into this subject area.

Topics include: basic principles of programming - problem, algorithm, program, basic principles of object-oriented programming - packages, classes, objects, simple and structured data types, Control structures, input/output, exception handling, abstraction, recursion

### Requirements for Contact Hours

Active participation, working on exercises

### Requirements for Independent Study Hours

Preparation and follow-up, working on exercises

### Bibliography

Lecture notes

Reges, S., Stepp, M.: Building Java Programs, Prentice Hall

## Module BIN-103 Fundamentals of Computer Science

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-GDI)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-103-01 Fundamentals of Computer Science, Compulsory         |
| <b>Person in Charge</b>                        | Wohlfeil, Stefan, Prof. Dr.                                     |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 1   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | none  |
| <b>Recommended Prerequisites</b>               | none  |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Computer science competencies: Understand structure and operation of computers. Efficiently use UNIX systems from the console. Assembler programming. Understand structure and operation of networks such as the Internet. General competencies: Read and understand computer science topics by using appropriate (scientific) literature.

## Submodule BIN-103-01 Fundamentals of Computer Science

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-GDI)   |
| <b>Person in Charge</b>                        | Wohlfeil, Stefan, Prof. Dr.                                     |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Suggestions for Independent Study</b>       |   |
| <b>Recommended Prerequisites</b>               | none  |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Computer science competencies: Understand structure and operation of computers. Efficiently use UNIX systems from the console. Assembler programming. Understand structure and operation of networks such as the Internet. General competencies: Read and understand computer science topics by using appropriate (scientific) literature.

### Content

Structure of computers, CPU architectures, Storage structures, low level programming with assembler; information encoding (ASCII, UTF), representation of numbers and characters, Structure and functionality of operating systems; management of CPU, RAM and persistent storage; using bash on UNIX systems; Internet basics, DNS, HTTP.

### Requirements for Contact Hours

Preparation and postprocessing of all lectures and exercises. Notes-taking in lecture. Active participation.

### Requirements for Independent Study Hours

Study all provided material; deepen knowledge using additional literature; successfully work on all exercises

### Bibliography

Helmut Herold, Bruno Lutz, Jürgen Wohlrab; Grundlagen der Informatik; Pearson Studium; 2012

## Module BIN-104 Theoretical Computer Science

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-TI)  |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module                                   |
| <b>Submodules</b>                              | BIN-104-01 Theoretical Computer Science, Compulsory |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.                         |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 1   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | None  |
| <b>Recommended Prerequisites</b>               | None  |
| <b>Examination</b>                             | Written or oral examination, experimental work      |

### Learning Outcomes

Formal, algorithmic, mathematical skills: Knowing formal languages, grammars generating them, automata accepting them, knowing and defining regular expressions for certain patterns  
Analysis and design skills: Knowing the concept of computability and identifying non-computable problems, defining own formal languages and implementing a parser for them, analyzing and abstracting problems and solving problems using regular and pushdown automata  
Methodological skills: Being able to recognize transferral of problems into different description options, being able to recognize and use alternative descriptions of the same language class

## Submodule BIN-104-01 Theoretical Computer Science

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-TI)  |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.   |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 1   |
| <b>Suggestions for Independent Study</b>       | Work on slides and literature, reflection and self-contained application of content |
| <b>Recommended Prerequisites</b>               | None  |
| <b>Examination</b>                             | Written or oral examination, experimental work                                      |

### Learning Outcomes

Formal, algorithmic, mathematical skills: Knowing formal languages, grammars generating them, automata accepting them, knowing and defining regular expressions for certain patterns  
Analysis and design skills: Knowing the concept of computability and identifying non-computable problems, defining own formal languages and implementing a parser for them, analyzing and abstracting problems and solving problems using regular and pushdown automata  
Methodological skills: Being able to recognize transferal of problems into different description options, being able to recognize and use alternative descriptions of the same language class

### Content

Basic knowledge about automata and machine models of different complexity (finite automata, pushdown automata, Turing machines),  
different classes of formal languages, Chomsky hierarchy and different forms of description of languages in one class, basics of compiler structure

### Requirements for Contact Hours

Lecture: Following presentations and examples, discussion, following executions and visualizations in learning software, reflection of content, self-contained application of subjects  
Exercise: Self-contained work on problems on paper and by using learning software, theoretical problems, presentation of problem solutions and project results

### Requirements for Independent Study Hours

Preparation and post-processing of lectures and exercises, self-contained work on problems, turning in homework in small groups, self-contained work on a project task in small groups, exam preparation, reading literature

### Bibliography

G. Vossen/K.-U. Witt: Grundkurs Theoretische Informatik, 3. Auflage, Vieweg  
J.Hopcroft/R. Motwani/J. Ullman: Introduction to Automata Theory, Languages and Computation (2.Auflage), Addison-Wesley

## Module BIN-105 Mathematics 2

|  |   |
|--|---|
| <b>Subheading</b>                              | Linear Algebra and Analytic Geometry (BIN-MAT2)                 |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-105-01 Mathematics 2, Compulsory                            |
| <b>Person in Charge</b>                        | Pigors, Adrian, Prof. Dr.                                       |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 2   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | None  |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical foundations of computer science (BIN-MAT1) |
| <b>Examination</b>                             | Written or oral examination, experimental work                  |

### Learning Outcomes

Formal and mathematical skills: knowing the concepts, algorithms and techniques of linear algebra that are required to understand applications in numerical analysis, computer graphics, image processing and animation; being able to use the methods of linear algebra in other areas of applied computer science. General skills: acquiring communicative competence (presenting and discussing proposed solutions).

## Submodule BIN-105-01 Mathematics 2

|  |   |
|--|---|
| <b>Subheading</b>                              | Linear Algebra and Analytic Geometry (BIN-MAT2)                 |
| <b>Person in Charge</b>                        | Pigors, Adrian, Prof. Dr.                                       |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 2   |
| <b>Suggestions for Independent Study</b>       | See literature  |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical foundations of computer science (BIN-MAT1) |
| <b>Examination</b>                             | Written or oral examination, experimental work                  |

### Learning Outcomes

Formal and mathematical skills: knowing the concepts, algorithms and techniques of linear algebra that are required to understand applications in numerical analysis, computer graphics, image processing and animation; being able to use the methods of linear algebra in other areas of applied computer science. General skills: acquiring communicative competence (presenting and discussing proposed solutions).

### Content

The essentials of linear algebra as part of higher mathematics, including selected topics from the areas:

- vectors and vector spaces,
- matrices and
- systems of linear equations, each with numerical methods and application examples. To illustrate the concepts and techniques, appropriate standard software is used.

### Requirements for Contact Hours

Participating actively, solving exercise problems

### Requirements for Independent Study Hours

Preparing and following up lectures, solving exercise problems, discussing material

### Bibliography

Lecture notes  
Teschl, G., Teschl, S.: Mathematik für Informatiker, Springer  
Hartmann, P.: Mathematik für Informatiker, Vieweg  
Locher, F.: Numerische Mathematik für Informatiker, Springer  
Schwarz, H. R.: Numerische Mathematik, Teubner

## Module BIN-106 Database Systems 1

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-DBS1)                                     |
| <b>Level of Module</b>                         | Basic module                                   |
| <b>Type of Module</b>                          | Compulsory module                              |
| <b>Submodules</b>                              | BIN-106-01 Database Systems 1, Compulsory      |
| <b>Person in Charge</b>                        | Heine, Felix, Prof. Dr.                        |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h                                   |
| <b>Semester</b>                                | 2  |
| <b>Duration of Module</b>                      | 1 semester                                     |
| <b>Prerequisites</b>                           | None   |
| <b>Recommended Prerequisites</b>               | BIN-102 Programming 1 (BIN-PR1)                |
| <b>Examination</b>                             | Written or oral examination, experimental work |

### Learning Outcomes

Analytical skills: Be able to become acquainted with an application domain, extract requirements, understand and structure a complex domain using ER diagrams

Design skills: Derive a database design from requirements

Technological skills: Database design as a process

Interdisciplinary skills: Social skills (team work), ability to transfer



## Submodule BIN-106-01 Database Systems 1

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-DBS1)   |
| <b>Person in Charge</b>                        | Heine, Felix, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                       |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 2  |
| <b>Suggestions for Independent Study</b>       | See literature   |
| <b>Recommended Prerequisites</b>               | BIN-102 Programming 1 (BIN-PR1) or MDI-102 Programming 1 (MDI-PR1) |
| <b>Examination</b>                             | Written or oral examination, experimental work                     |

### Learning Outcomes

Analytical skills: Be able to become acquainted with an application domain, extract requirements, understand and structure a complex domain using ER diagrams  
Design skills: Derive a database design from requirements  
Technological skills: Database design as a process  
Interdisciplinary skills: Social skills (team work), ability to transfer

### Content

In this module, important elements and concepts like data modeling and relational data models are presented. Among others, the following topics are dealt with:

- Creation of a database design and translation into a database schema
- Data manipulation in the relational model
- SQL
- Introduction to database programming
- Normalization The topics are trained practically and deepened using a database system.

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing

### Bibliography

R. Elmasri, S. Navathe; Grundlagen von Datenbanksystemen; Pearson Education, 2009  
A. Heuer, G. Saake; Datenbanken: Konzepte und Sprachen; mitp, 2013  
A. Kemper, A. Eickler; Datenbanksysteme; Oldenburg, 2015  
Kudraß, T. (Hrsg.); Taschenbuch Datenbanken, Hanser, 2015

## Module BIN-107 Statistics

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-STAT)  |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-107-01 Statistics, Compulsory                               |
| <b>Person in Charge</b>                        | Ahlers, Volker, Prof. Dr.                                       |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 2   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | none  |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical Foundations of Computer Science (BIN-MAT1) |
| <b>Examination</b>                             | Written or oral examination, experimental work                  |

### Learning Outcomes

Algorithmic and mathematical skills: Getting to know, using, comparing, and evaluating stochastic terms and methods for the description and analysis of large datasets. Interpretation and evaluation of results of stochastic methods and statistical analysis.

Interdisciplinary skills: Communicative skills (presentation and discussion of solution approaches).

## Submodule BIN-107-01 Statistics

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-STAT)   |
| <b>Person in Charge</b>                        | Ahlers, Volker, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 2  |
| <b>Suggestions for Independent Study</b>       | see literature   |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical Foundations of Computer Science (BIN-MAT1) or MDI-100 Mathematical Foundations of Computer Science (MDI-MAT1) |
| <b>Examination</b>                             | Written or oral examination, experimental work   |

### Learning Outcomes

Algorithmic and mathematical skills: Getting to know, using, comparing, and evaluating stochastic terms and methods for the description and analysis of large datasets. Interpretation and evaluation of results of stochastic methods and statistical analysis.

Interdisciplinary skills: Communicative skills (presentation and discussion of solution approaches).

### Content

Fundamental terms and methods of probability theory and statistics, such as:

- Descriptive statistics: mean, standard deviation, median, quantile, histogram, regression and correlation analysis
- Combinatorics
- Probability theory: event, probability, Bayes' theorem, random variable, expectation value, variance, discrete and continuous distributions, fundamental theorem of statistics, limit theorems
- Pseudorandom numbers
- Inferential statistics: estimation, tests, significance levels, type I and type II errors The methods are practised using well-established statistics software.

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and review of the lectures, reading literature

### Bibliography

Lecture notes

Sachs, M.: Wahrscheinlichkeitsrechnung und Statistik, Hanser

Teschl, G., Teschl, S.: Mathematik für Informatiker, Band 2, Springer

## Module BIN-108 Programming 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-PR2)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-108-01 Programming 2, Compulsory                            |
| <b>Person in Charge</b>                        | Garmann, Robert, Prof. Dr.                                      |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 2   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | none  |
| <b>Recommended Prerequisites</b>               | BIN-102 (BIN-PR1)   |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Algorithmic skills: analyze a specific problem and solve it algorithmically.

Analytical skills: ability to (semi-)formally describe an informally presented problem using a modeling language (UML)

Design skills: Turning UML models into executable programs, taking the basic rules of the software architecture into account

Realization skills: mastering the object-oriented programming paradigm, creating and testing programs using appropriate tools.

## Submodule BIN-108-01 Programming 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-PR2)   |
| <b>Person in Charge</b>                        | Garmann, Robert, Prof. Dr.                                      |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 1   |
| <b>Suggestions for Independent Study</b>       | see literature  |
| <b>Recommended Prerequisites</b>               | BIN-102 (BIN-PR1)   |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Algorithmic skills: analyze a specific problem and solve it algorithmically.

Analytical skills: ability to (semi-)formally describe an informally presented problem using a modeling language (UML)

Design skills: Turning UML models into executable programs, taking the basic rules of the software architecture into account

Realization skills: mastering the object-oriented programming paradigm, creating and testing programs using appropriate tools.

### Content

Based on the principles learned in Programming 1 further concepts of object-oriented programming are presented. Specific topics include: inheritance and polymorphism, concurrent programming and the development of graphical user interfaces. In addition, the basic principles of object-oriented analysis and design are introduced based on the UML class diagram.

### Requirements for Contact Hours

Active participation, working on exercises

### Requirements for Independent Study Hours

Preparation and follow-up, working on exercises

### Bibliography

Lecture notes

Reges, S., Stepp, M.: Building Java Programs, Prentice Hall

## Module BIN-109 Algorithms and Data Structures

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-AD)  |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module                                     |
| <b>Submodules</b>                              | BIN-109-01 Algorithms and Data Structures, Compulsory |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.                           |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 2   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | None  |
| <b>Recommended Prerequisites</b>               | BIN-102 (BIN-PR1)                                     |
| <b>Examination</b>                             | Written or oral examination, experimental work        |

### Learning Outcomes

Formal and algorithmic skills: Knowing expense estimates with the help of  $O$  notation and using them on algorithms, ability to compare algorithms with respect to their runtime, knowing and comparing good algorithms for important standard problems (e.g. sorting)

Analysis, design and realization skills: Knowing important linear and non-linear data structures and using them sensibly for a given problem, ability to know, compare and select different implementation variants for important data structures, ability to develop efficient data structures and algorithms for new problems, knowing and efficiently applying data structures from standard libraries

## Submodule BIN-109-01 Algorithms and Data Structures

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-DA)  |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.   |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 2   |
| <b>Suggestions for Independent Study</b>       | Work on slides and literature, reflection and self-contained application of content |
| <b>Recommended Prerequisites</b>               | BIN-102 (BIN-PR1) or MDI-109 (MDI-PR1)  |
| <b>Examination</b>                             | Written or oral examination, experimental work                                      |

### Learning Outcomes

Formal and algorithmic skills: Knowing expense estimates with the help of  $O$  notation and using them on algorithms, ability to compare algorithms with respect to their runtime, knowing and comparing good algorithms for important standard problems (e.g. sorting)

Analysis, design and realization skills: Knowing important linear and non-linear data structures and using them sensibly for a given problem, ability to know, compare and select different implementation variants for important data structures, ability to develop efficient data structures and algorithms for new problems, knowing and efficiently applying data structures from standard libraries

### Content

Basic knowledge of structured and efficient software development: analysis of algorithm efficiency, linear and non-linear data structures (lists, trees, heaps), sorting algorithms, paradigms of efficient algorithms

### Requirements for Contact Hours

Lecture: Following presentations and examples, discussion, following executions and visualizations in learning software, reflection of content, self-contained application of subjects

Exercise: Self-contained work on problems on paper and by using learning software, theoretical problems, presentation of problem solutions and project results

### Requirements for Independent Study Hours

Preparation and post-processing of lectures and exercises, self-contained work on problems, turning in homework in small groups, self-contained work on a project task in small groups, exam preparation, reading literature

### Bibliography

M. Goodrich/R. Tamassia: Data Structures and Algorithms in Java, 4th edition, Wiley  
T.H. Cormen, C.E. Leiserson, R.L. Rivest; Introduction to Algorithms; MIT Press

## Module BIN-110 Programming 3

|  |   |
|--|---|
| <b>Subheading</b>                              | C/C++ (BIN-PR3)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-110-01 Programming 3, Compulsory                                |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 3   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | none  |
| <b>Recommended Prerequisites</b>               | BIN-102 Programming I (BIN-PR1)<br>BIN-108 Programming II (BIN-PR2) |
| <b>Examination</b>                             | Written or oral exam, experimental work                             |

### Learning Outcomes

Technological skills: Students can use the tools gcc, g++ and make umgehen and understand compiler error messages

Design, implementation and methodic skills: Students understand the C meory model and can solve typical programming problems in C. Students have a good command of the core concepts of object orientation in C++ and can solve simple C++ programming problems.



## Submodule BIN-110-01 Programming 3

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-PR3)   |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 3   |
| <b>Suggestions for Independent Study</b>       | Siehe Literatur   |
| <b>Recommended Prerequisites</b>               | BIN-102 Programming I (BIN-PR1)<br>BIN-108 Programming II (BIN-PR2) |
| <b>Examination</b>                             | Written or oral exam, experimental work                             |

### Learning Outcomes

Technological skills: Students can use the tools gcc, g++ and make umgehen and understand compiler error messages

Design, implementation and methodic skills: Students understand the C meory model and can solve typical programming problems in C. Students have a good command of the core concepts of object orientation in C++ and can solve simple C++ programming problems.

### Content

Structure and building of C programs  
Control structures  
Kontrollstrukturen  
Data organisation  
Pointers  
Functions  
Input/output  
C++ vs. C  
Reference types  
Classes, constructors, destructors, object composition  
Operators  
Inheritance, polymorphism

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

Vogt, Carsten: C für Java Programmierer, Hanser 2007  
C und C++ für Java-Programmierer, Regionales Rechenzentrum für Niedersachsen, Leibniz Universität Hannover  
Wolf, Jürgen: C von A-Z, 2. Auflage, Galileo (as of now: Rheinwerk) 2006  
Bruce Eckel: Thinking in C++, Prentice Hall

## Module BIN-111 Mathematics 3

|  |   |
|--|---|
| <b>Subheading</b>                              | Calculus (BIN-MAT3)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-111-01 Mathematics 3, Compulsory                            |
| <b>Person in Charge</b>                        | Pigors, Adrian, Prof. Dr.                                       |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 3   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | None  |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical foundations of computer science (BIN-MAT1) |
| <b>Examination</b>                             | Written or oral examination, experimental work                  |

### Learning Outcomes

Formal and mathematical skills: knowing the concepts, algorithms and techniques of mathematical analysis and numerical mathematics that are required to understand mathematical statistics and applications in the fields of information systems and animation; being able to use the methods of analysis in other areas of applied computer science.

General skills: acquiring communicative competence (presenting and discussing proposed solutions).

## Submodule BIN-111-01 Mathematics 3

|  |   |
|--|---|
| <b>Subheading</b>                              | Calculus (BIN-MAT3)   |
| <b>Person in Charge</b>                        | Pigors, Adrian, Prof. Dr.                                       |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 3   |
| <b>Suggestions for Independent Study</b>       | See literature  |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical foundations of computer science (BIN-MAT1) |
| <b>Examination</b>                             | Written or oral examination, experimental work                  |

### Learning Outcomes

Formal and mathematical skills: knowing the concepts, algorithms and techniques of mathematical analysis and numerical mathematics that are required to understand mathematical statistics and applications in the fields of information systems and animation; being able to use the methods of analysis in other areas of applied computer science.

General skills: acquiring communicative competence (presenting and discussing proposed solutions).

### Content

Selected topics from the areas:

- differential calculus of one and several variables,
- integral calculus of one variable and
- function series, each with numerical methods and application examples. To illustrate the concepts and techniques, appropriate standard software is used.

### Requirements for Contact Hours

Participating actively, solving exercise problems

### Requirements for Independent Study Hours

Preparing and following up lectures, solving exercise problems, discussing material

### Bibliography

Lecture notes

Teschl, G., Teschl, S.: Mathematik für Informatiker 1/2, Springer

Hartmann, P.: Mathematik für Informatiker, Vieweg

Brill, M.: Mathematik für Informatiker, Hanser

Locher, F.: Numerische Mathematik für Informatiker, Springer

Schwarz, H. R.: Numerische Mathematik, Teubner

## Module BIN-112 Operating Systems and Networks 1

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-BSN1)   |
| <b>Level of Module</b>                         | Basic module   |
| <b>Type of Module</b>                          | Compulsory module  |
| <b>Submodules</b>                              | BIN-112-01 Operating Systems and Networks 1, Compulsory  |
| <b>Person in Charge</b>                        | Hovestadt, Matthias, Prof. Dr.   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 3  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | none   |
| <b>Recommended Prerequisites</b>               | BIN-103 Fundamentals of Computer Science (BIN-GDI), BIN-102 Programming 1 (BIN-PR1)<br>BIN-108 Programming 2 (BIN-PR2) |
| <b>Examination</b>                             | Written or oral examination, experimental work   |

### Learning Outcomes

Technological skills: Students have knowledge on basics on architecture, structure and operation of operating systems and computer networks, particularly the concept of processes, file management and network layers.

Design, implementation and methodic skills: Students are able to analyze typical issues at the system level, generating appropriate programming based solutions. Students are able to work in a UNIX-based environment with a core set of UNIX commands.

Comprehensive: social skills (team work), transfer skills.

## Submodule BIN-112-01 Operating Systems and Networks 1

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BSN1)  |
| <b>Person in Charge</b>                        | Hovestadt, Matthias, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 3   |
| <b>Suggestions for Independent Study</b>       | Using a Linux-based environment for tasks on exercise sheets is highly recommended. Linux may be executed in a virtual machine, using any available virtualization platform.  |
| <b>Recommended Prerequisites</b>               | BIN-103 Fundamentals of Computer Science (BIN-GDI), BIN-102 Programming 1 (BIN-PR1)<br>BIN-108 Programming 2 (BIN-PR2)<br>resp.<br>MDI-103 Fundamentals of Computer Science (MDI-GDI), MDI-102 Programming 1 (MDI-PR1)<br>MDI-109 Programming 2 (MDI-PR2) |
| <b>Examination</b>                             | Written or oral examination, experimental work  |

### Learning Outcomes

Technological skills: Students have knowledge on basics on architecture, structure and operation of operating systems and computer networks, particularly the concept of processes, file management and network layers.

Design, implementation and methodic skills: Students are able to analyze typical issues at the system level, generating appropriate programming based solutions. Students are able to work in a UNIX-based environment with a core set of UNIX commands.

Comprehensive: social skills (team work), transfer skills.

### Content

Fundamentals of modern operating systems, history of UNIX operating systems, using bash, interrupts, processes, file operation, network access, network layer model, physical layer, data link layer, network layer, transport layer

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

Helmut Herold: Linux- Unix Grundlagen. Kommandos und Konzepte, Addison-Wesley

H. Herold: Linux- Unix- Systemprogrammierung, Addison-Wesley

Silberschatz, Abraham; Peter Galvin, Greg Gagne: Operating System Concepts, John Wiley & Sons Inc.

Tanenbaum, Andrew S.: Moderne Betriebssysteme, Pearson Studium

## Module BIN-113 Database Systems 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-DBS2)  |
| <b>Level of Module</b>                         | Specific module                                     |
| <b>Type of Module</b>                          | Compulsory module                                   |
| <b>Submodules</b>                              | BIN-113-01 Database Systems 2, Compulsory           |
| <b>Person in Charge</b>                        | Koschel, Arne, Prof. Dr.                            |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68h h / 112 h                                       |
| <b>Semester</b>                                | 3   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | none  |
| <b>Recommended Prerequisites</b>               | BIN-106 (BIN-DBS1), BIN-108 Programming 2 (BIN-PR2) |
| <b>Examination</b>                             | Written or oral examination, experimental work      |

### Learning Outcomes

Analytical skills: Ability to derive for a given application area requirements with respect to data access, ability to compare, evaluate and select DB access technologies based on the application, have knowledge of standard situations in the field of data access (pattern, Web and enterprise architectures).

Methodological skills: Transfer skills for existing data access technologies to introduce new IT methods into an IT infrastructure that has often evolved over time.

Technological skills: Understanding for the concepts and functioning of: DBS programming, O/R mapping, persistence frameworks, DBS transactions

## Submodule BIN-113-01 Database Systems 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-DBS2, MDI-DBS2)  |
| <b>Person in Charge</b>                        | Koschel, Arne, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 3   |
| <b>Suggestions for Independent Study</b>       | See literature  |
| <b>Recommended Prerequisites</b>               | BIN-106 (BIN-DBS1), BIN-108 (BIN-PR2)<br>or MDI-107 (MDI-DBS1), MDI-109 (MDI-PR2) |
| <b>Examination</b>                             | Written or oral examination, experimental work                                    |

### Learning Outcomes

Analytical skills: Ability to derive for a given application area requirements with respect to data access, ability to compare, evaluate and select DB access technologies based on the application, have knowledge of standard situations in the field of data access (pattern, Web and enterprise architectures).

Methodological skills: Transfer skills for existing data access technologies to introduce new IT methods into an IT infrastructure that has often evolved over time.

Technological skills: Understanding for the concepts and functioning of: DBS programming, O/R mapping, persistence frameworks, DBS transactions

### Content

Data access and data management in software and/or information systems - concepts, technologies, architectures, evaluation. Topics include:

- DB-internal programming (stored procedures, trigger)
- Relational DB integration (static, dynamic) client-DB server
- Persistence frameworks. O/R mapping
- DBS transactions
- potentially selected additional advanced topics in DBS such as Key Value stores or embedded OO-DBS

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

Lecture notes (script)

Conrad, S. et al.: Enterprise Application Integration - Grundlagen, Konzepte, Entwurfsmuster, Praxisbeispiele., Spektrum/Elsevier, 2005.

Heuer, A., Saake G., Sattler, K.: Datenbanken: Konzepte und Sprachen, mitp, newest release.

Kudraß, T. (Hrsg.): Taschenbuch Datenbanken, Hanser, newest release.

Current (Web) sources , for example, about the Java Persistence API.

## Module BIN-114 Programming Project

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-PP)                                   |
| <b>Level of Module</b>                         | Basic module                               |
| <b>Type of Module</b>                          | Compulsory module                          |
| <b>Submodules</b>                              | BIN-114-01 Programming Project, Compulsory |
| <b>Person in Charge</b>                        | Dunkel, Jürgen, Prof. Dr.                  |
| <b>ECTS Credits</b>                            | 4  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 52 h                                |
| <b>Semester</b>                                | 3  |
| <b>Duration of Module</b>                      | 1 semester                                 |
| <b>Prerequisites</b>                           | none                                       |
| <b>Recommended Prerequisites</b>               | BIN-102 (BIN-PR1), BIN-108 (BIN-PR2)       |
| <b>Examination</b>                             | experimental work                          |

### Learning Outcomes

Design and realization skills: Using technical knowledge acquired to solve a problem; creating and testing a larger software program in the team

Project management skills: Ability to organize and guide projects

Social skills: Teamwork, communication, practicing presentations



## Submodule BIN-114-01 Programming Project

|  |                                      |
|--|--------------------------------------|
| <b>Subheading</b>                              | (BIN-PP)                             |
| <b>Person in Charge</b>                        | Dunkel, Jürgen, Prof. Dr.            |
| <b>Language of Instruction</b>                 | German                               |
| <b>Curriculum Allocation</b>                   | BIN                                  |
| <b>Course Type, Contact Hours per Week</b>     | Project, 4 SWS                       |
| <b>ECTS Credits</b>                            | 4                                    |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 52 h                          |
| <b>Semester</b>                                | 3                                    |
| <b>Suggestions for Independent Study</b>       | see literature                       |
| <b>Recommended Prerequisites</b>               | BIN-102 (BIN-PR1), BIN-108 (BIN-PR2) |
| <b>Examination</b>                             | experimental work                    |

### Learning Outcomes

Design and realization skills: Using technical knowledge acquired to solve a problem; creating and testing a larger software program in the team

Project management skills: Ability to organize and guide projects

Social skills: Teamwork, communication, practicing presentations.

### Content

Developing a software system to a specific problem. Preparing the project by literature research. Project planing, design, implementation and documentation.

### Requirements for Contact Hours

active involvement in the project, also organizational roles

### Requirements for Independent Study Hours

implementation of specific project tasks: e.g. design, programming, testing, documentation

### Bibliography

project specific

## Module BIN-115 Business Administration

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-BW)                                       |
| <b>Level of Module</b>                         | Basic module                                   |
| <b>Type of Module</b>                          | Compulsory module                              |
| <b>Submodules</b>                              | BIN-115-01 Business Administration, Compulsory |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.                       |
| <b>ECTS Credits</b>                            | 2  |
| <b>Contact Hours / Independent Study Hours</b> | 17 h / 43 h                                    |
| <b>Semester</b>                                | 3  |
| <b>Duration of Module</b>                      | 1 semester                                     |
| <b>Prerequisites</b>                           | none   |
| <b>Recommended Prerequisites</b>               | none   |
| <b>Examination</b>                             | Written or oral exam, experimental work        |

### Learning Outcomes

Students have a basic understanding of an entrepreneur's economic challenges. Students have a good command of business definitions and are able to use them selectively. They can create an advance turnover tax return, maintain a simple bookkeeping as well as analyze a simple annual financial statement.

## Submodule BIN-115-01 Business Administration

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BW)                                |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.                |
| <b>Language of Instruction</b>                 | German                                  |
| <b>Curriculum Allocation</b>                   | BIN, MDI                                |
| <b>Course Type, Contact Hours per Week</b>     | Lecture, 2 SWS                          |
| <b>ECTS Credits</b>                            | 2                                       |
| <b>Contact Hours / Independent Study Hours</b> | 17 h / 34 h                             |
| <b>Semester</b>                                | 3                                       |
| <b>Suggestions for Independent Study</b>       | See literature                          |
| <b>Recommended Prerequisites</b>               | none                                    |
| <b>Examination</b>                             | Written or oral exam, experimental work |

### Learning Outcomes

Students have a basic understanding of an entrepreneur's economic challenges. Students have a good command of business definitions and are able to use them selectively. They can create an advance turnover tax return, maintain a simple bookkeeping as well as analyze a simple annual financial statement.

### Content

Business goals, legal forms of companies, tax law, financial reporting, company organization, operating process, operational cost structure, management accounting, operational cost and activity accounting.

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

- 1) Einführung in die Allgemeine Betriebswirtschaftslehre, 4. September 2013 von Günter Wöhe und Ulrich Döringmax
- 2) .Grundzüge der Betriebswirtschaftslehre, 22. August 2012 von Henner Schierenbeck und Claudia B Wöhle
- 3) Buchführung 2 DATEV-Kontenrahmen 2014: Abschlüsse nach Handels- und Steuerrecht Betriebswirtschaftliche Auswertung 24. Februar 2015 von Manfred Bornhofen und Martin C. Bornhofen
- 4) Praxisleitfaden Steuerrecht für Existenzgründer von Karin Nickening (erscheint voraussichtlich Aug./Sept. 2015, Springer-Verlag)
- 5) Vorlesungsskript für internes und externes Rechnungswesen, Mai 2015

## Module BIN-116 English

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-EN)                                |
| <b>Level of Module</b>                         | Basic module                            |
| <b>Type of Module</b>                          | Compulsory module                       |
| <b>Submodules</b>                              | BIN-116-01 English, Compulsory          |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.                |
| <b>ECTS Credits</b>                            | 2                                       |
| <b>Contact Hours / Independent Study Hours</b> | 17 h / 43 h                             |
| <b>Semester</b>                                | 1                                       |
| <b>Duration of Module</b>                      | 1 semester                              |
| <b>Prerequisites</b>                           | none                                    |
| <b>Recommended Prerequisites</b>               | none                                    |
| <b>Examination</b>                             | Written or oral exam, experimental work |

### Learning Outcomes

Extension of basic subject vocabulary and of general word power. Acquiring knowledge of creating subject-specific texts in English. Discussion and presentation skills. Subject-specific presentation.

## Submodule BIN-116-01 English

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-EN)                                |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.                |
| <b>Language of Instruction</b>                 | German                                  |
| <b>Curriculum Allocation</b>                   | BIN, MDI                                |
| <b>Course Type, Contact Hours per Week</b>     | Tutorial, 2 SWS                         |
| <b>ECTS Credits</b>                            | 2                                       |
| <b>Contact Hours / Independent Study Hours</b> | 17 h / 43 h                             |
| <b>Semester</b>                                | 1                                       |
| <b>Suggestions for Independent Study</b>       | See literature                          |
| <b>Recommended Prerequisites</b>               | none                                    |
| <b>Examination</b>                             | Written or oral exam, experimental work |

### Learning Outcomes

Extension of basic subject vocabulary and of general word power. Acquiring knowledge of creating subject-specific texts in English. Discussion and presentation skills. Subject-specific presentation.

### Content

Working through the chapters of the employed literature including learning of subject-specific vocabulary, discussion of grammar issues with corresponding exercises, discussion of subject-specific and general issues like software development, customer care, dealing with customers and complaints, after sales service, business travel and business dinners, small talk, presentations.

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the sessions, reading literature

### Bibliography

English for IT Professionals, Cornelsen Verlag  
In Company, MacMillan Verlag  
Log On - English for IT Professions, Hueber Verlag

## Module BIN-200 Computer Graphics 1

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-CG1)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-200-01 Computer Graphics 1, Compulsory                      |
| <b>Person in Charge</b>                        | Sprengel, Frauke, Prof. Dr.                                     |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 4   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All module examinations from 1st semester                       |
| <b>Recommended Prerequisites</b>               | Mathematics 1-3, programming 1-3                                |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Mathematical, algorithmic, interdisciplinary skills: Knowledge of the basic mathematical-geometrical and physical principles of rendering and lighting objects in space and the practical application of this knowledge. Analysis, design and realization skills: Application of the skills acquired in smaller projects using a graphics library

## Submodule BIN-200-01 Computer Graphics 1

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-CG1)  |
| <b>Person in Charge</b>                        | Sprengel, Frauke, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German   |
| <b>Curriculum Allocation</b>                   | BIN  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 4  |
| <b>Suggestions for Independent Study</b>       | see literature   |
| <b>Recommended Prerequisites</b>               | BIN-100 Mathematical foundations of computer science (BIN-MAT1)<br>BIN-105 Linear Algebra and Analytic Geometry (BIN-MAT2)<br>BIN-111 Calculus (BIN-MAT3)<br>BIN-102 Programming I (BIN-PR1),<br>BIN-108 Programming II (BIN-PR2)<br>BIN-110 Programming III (BIN-PR3) |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work  |

### Learning Outcomes

Mathematical, algorithmic, interdisciplinary skills: Knowledge of the basic mathematical-geometrical and physical principles of rendering and lighting objects in space and the practical application of this knowledge. Analysis, design and realization skills: Application of the skills acquired in smaller projects using a graphics library

### Content

Basic principles, affine transformations and perspective projection in descriptive geometry, curves and areas, visibility, transparency, lighting models, introduction to a standard 3D library, programming examples

### Requirements for Contact Hours

Active participation, individual task-solving in small groups, discussion

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature, individual or group task-solving, individual discussion

### Bibliography

Lecture notes

Alan Watt: 3D-Computergraphik, Pearson Studium

Foley, van Dam, Feiner, Hughes: Computer Graphics: Principles and Practice, Addison Wesley

Alfred Nischwitz, Peter Haberäcker: Computergraphik und Bildverarbeitung, Vieweg

## Module BIN-201 Software Engineering 1

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-SE1)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-201-01 Software Engineering 1, Compulsory                   |
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 4   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All module examinations from 1st semester                       |
| <b>Recommended Prerequisites</b>               | Programming 1-3, databases 1, programming project               |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Analytical skills: Ability to familiarize oneself in an area of application, extract requirements, record, structure and model a complex domain, knowledge of standard situations in the field of modeling (pattern, architecture)

Design skills: Ability to derive a system concept from requirements (from the knowledge of standard architectures), transfer a system concept into a productively functional implementation, understanding quality control as an integral element of the development project

Interdisciplinary skills: Setting up and implementing projects, social skills (teamwork), transfer skills, independent processing of new methods



## Submodule BIN-201-01 Software Engineering 1

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-SE1)   |
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 4   |
| <b>Suggestions for Independent Study</b>       | See literature  |
| <b>Recommended Prerequisites</b>               | Programming 1-3, databases 1, programming project               |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Analytical skills: Ability to familiarize oneself in an area of application, extract requirements, record, structure and model a complex domain, knowledge of standard situations in the field of modeling (pattern, architecture)

Design skills: Ability to derive a system concept from requirements (from the knowledge of standard architectures), transfer a system concept into a productively functional implementation, understanding quality control as an integral element of the development project

Interdisciplinary skills: Setting up and implementing projects, social skills (teamwork), transfer skills, independent processing of new methods

### Content

Software development models, processes and methods to develop large-scale software systems, patterns. The different phases and work steps are presented in detail for a standard software development process. This means

- the basic principles, results and procedure are dealt with for each phase of the software development,
- modeling (with UML) is practiced in the project context,
- an introduction to analysis, design and architecture patterns, and
- basic methods for quality control are presented.

### Requirements for Contact Hours

Active participation, solving exercises

### Requirements for Independent Study Hours

Pre- and post-preparation of the content

### Bibliography

Grechenig, T., Bernhart, M., Breiteneder, R., Kappel, K.: Softwaretechnik, Pearson Studium.  
Jacobson, I., G. Booch, J. Rumbaugh: The Unified Software Development Process, Addison Wesley.  
Gamma, E. R., Helm, R. Johnson, J. Vlissides: Design Patterns, Reading, MA, Addison Wesley.

## Module BIN-202 Operating Systems and Networks 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BSN2)  |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-202-01 Operating Systems and Networks 2, Compulsory   |
| <b>Person in Charge</b>                        | Hovestadt, Matthias, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 4   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All module examinations from 1st semester.  |
| <b>Recommended Prerequisites</b>               | BIN-103 Fundamentals of Computer Science (BIN-GDI), BIN-102 Programming 1 (BIN-PR1)<br>BIN-108 Programming 2 (BIN-PR2), BIN-112 Operating Systems and Networks I (BIN-BSN1) |
| <b>Examination</b>                             | Written or oral examination, experimental work  |

### Learning Outcomes

Technological skills: Students have advanced knowledge on computer networks, particularly dynamic routing protocols and IPv6. Students also have advanced knowledge on operating systems including parallel computing and signals.

Design, implementation and methodic skills: Students are able to analyze typical issues at system level, generating appropriate programming based solutions. Students are able to work in a UNIX-based environment with a core set of UNIX commands.

Comprehensive: social skills (team work), transfer skills.

## Submodule BIN-202-01 Operating Systems and Networks 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BSN2)  |
| <b>Person in Charge</b>                        | Hovestadt, Matthias, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 4   |
| <b>Suggestions for Independent Study</b>       | Using a Linux-based environment for tasks on exercise sheets is highly recommended. Linux may be executed in a virtual machine, using any available virtualization platform.  |
| <b>Recommended Prerequisites</b>               | BIN-103 Fundamentals of Computer Science (BIN-GDI), BIN-102 Programming 1 (BIN-PR1)<br>BIN-108 Programming 2 (BIN-PR2), BIN-112 Operating Systems and Networks I (BIN-BSN1)<br>resp.<br>MDI-103 Fundamentals of Computer Science (MDI-GDI), MDI-102 Programming 1 (MDI-PR1)<br>MDI-109 Programming 2 (MDI-PR2), MDI-114 Operating Systems and Networks I (MDI-BSN1) |
| <b>Examination</b>                             | Written or oral examination, experimental work  |

### Learning Outcomes

Technological skills: Students have advanced knowledge on computer networks, particularly dynamic routing protocols and IPv6. Students also have advanced knowledge on operating systems including parallel computing and signals.

Design, implementation and methodic skills: Students are able to analyze typical issues at system level, generating appropriate programming based solutions. Students are able to work in a UNIX-based environment with a core set of UNIX commands.

Comprehensive: social skills (team work), transfer skills.

### Content

File programming, forking of processes, threads, inter-process communication, signals, network programming, routing algorithms, IPv6, network security

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

Helmut Herold: Linux- Unix Grundlagen. Kommandos und Konzepte, Addison-Wesley

H. Herold: Linux- Unix- Systemprogrammierung, Addison-Wesley

Silberschatz, Abraham; Peter Galvin, Greg Gagne: Operating System Concepts, John Wiley & Sons Inc.

Tanenbaum, Andrew S.: Moderne Betriebssysteme, Pearson Studium

## Module BIN-203 Web Technologies

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-WT)   |
| <b>Level of Module</b>                         | Basic module   |
| <b>Type of Module</b>                          | Compulsory module  |
| <b>Submodules</b>                              | BIN-203-01 Web Technologies, Compulsory  |
| <b>Person in Charge</b>                        | Dunkel, Jürgen, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 4  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | BIN-108 Programming II (BIN-PR2)<br>Operating systems and networks.  |
| <b>Recommended Prerequisites</b>               | BIN-102 Programming I (BIN-PR1),<br>BIN-108 Programming II (BIN-PR2)<br>BIN-110 Programming III (BIN-PR3)<br>BIN-112 Operating systems and networks 1 (BIN-BSN1) |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work  |

### Learning Outcomes

Technological skills: knowledge about the essential components of websystems, in particular how they interact using specific protocols

Design skills: ability to design of websystems taking user ergonomics into account.

Choosing and applying an appropriate software architecture.

Realization skills: implementation of websystems applying current technologies.

## Submodule BIN-203-01 Web Technologies

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-WT)   |
| <b>Person in Charge</b>                        | Dunkel, Jürgen, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 4  |
| <b>Suggestions for Independent Study</b>       | see literature   |
| <b>Recommended Prerequisites</b>               | BIN-102 Programming I (BIN-PR1),<br>BIN-108 Programming II (BIN-PR2)<br>BIN-110 Programming III (BIN-PR3)<br>BIN-112 Operating systems and networks 1 (BIN-BSN1) |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work  |

### Learning Outcomes

Technological skills: knowledge about the essential components of websystems, in particular how they interact using specific protocols

Design skills: ability to design of websystems taking user ergonomics into account.

Choosing and applying an appropriate software architecture.

Realization skills: implementation of websystems applying current technologies.

### Content

Basic concepts and technologies of websystems.

- webservice architecture and network protocols (HTTP)
- markup languages (HTML, CSS, XML, JSON)
- Responsive design
- Serverside technologies (e.g. servlets, JSPs, PHP, ..)
- clientside technologies (JavaScript, Ajax)
- selected frameworks (bspw. JSF, Angular,..)
- web project

### Requirements for Contact Hours

Active participation, solving exercises, project work

### Requirements for Independent Study Hours

Pre- and post-preparation of the content

### Bibliography

A. Tannebaum: Computernetzwerke, Pearson.

P. Müller: Webseiten gestalten mit HTML und CSS, galileo.

A. Ertel, K. Labrenz: Responsive Web Design

M. Kurz: JavaServer Faces, dpunkt.

C. Wentz: JavaScript, galileo.

further literature to special topics

## Module BIN-204 Seminar

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BSEM)                                      |
| <b>Level of Module</b>                         | Specific module                                 |
| <b>Type of Module</b>                          | Compulsory module                               |
| <b>Submodules</b>                              | BIN-204-01 Seminar, Compulsory                  |
| <b>Person in Charge</b>                        | Wohlfeil, Stefan, Prof. Dr.                     |
| <b>ECTS Credits</b>                            | 4   |
| <b>Contact Hours / Independent Study Hours</b> | 34 h / 86 h                                     |
| <b>Semester</b>                                | 4   |
| <b>Duration of Module</b>                      | 1 semester                                      |
| <b>Prerequisites</b>                           | All module examinations from 1st semester       |
| <b>Recommended Prerequisites</b>               | All modules of semesters 1, 2, and 3            |
| <b>Examination</b>                             | Term paper, presentation, compulsory attendance |

### Learning Outcomes

Computer science competencies: Students deepen the contents of some modules of semesters 1, 2, and 3 or complete it. By working with literature and working on new topics students increase their analytical competencies and technological competencies. Social competencies: Students learn to work with literature on their own. They can present scientific contents written and orally. They use correct language and present convincingly. In discussions they learn to critically reflect the contents of the seminar.

## Submodule BIN-204-01 Seminar

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BSEM)                                      |
| <b>Person in Charge</b>                        | Wohlfeil, Stefan, Prof. Dr.                     |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Seminar, 4 SWS                                  |
| <b>ECTS Credits</b>                            | 4   |
| <b>Contact Hours / Independent Study Hours</b> | 34 h / 86 h                                     |
| <b>Suggestions for Independent Study</b>       |   |
| <b>Recommended Prerequisites</b>               | All modules of semesters 1, 2, and 3            |
| <b>Examination</b>                             | Term paper, presentation, compulsory attendance |

### Learning Outcomes

Computer science competencies: Students deepen the contents of some modules of semesters 1, 2, and 3 or complete it. By working with literature and working on new topics students increase their analytical competencies and technological competencies. Social competencies: Students learn to work with literature on their own. They can present scientific contents written and orally. They use correct language and present convincingly. In discussions they learn to critically reflect the contents of the seminar.

### Content

#### Requirements for Contact Hours

Give presentation about assigned topic. Listen to all other presentations. Ask questions and participate in discussions. (compulsory attendance)

#### Requirements for Independent Study Hours

Search literature about assigned topic using the library and the Digital Libraries of ACM, IEEE. Prepare a presentation about the topic and write a paper (report) about it.

### Bibliography

## Module BIN-205 Software Engineering 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-SE2)   |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-205-01 Software Engineering 2, Compulsory                   |
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 5   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All module examinations from 1st and 2nd semester               |
| <b>Recommended Prerequisites</b>               | Software Engineering 1  |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Project management skills: Ability to plan, manage and control projects; knowing and being able to evaluate basic economic conditions and their effects; understanding HR management as a success factor  
Design skills: Ability to transfer a system concept into a productively functional implementation, understanding quality assurance and usability engineering as integral elements in the development project  
Technological skills: Sound knowledge in the selected subject area of software technology  
Interdisciplinary skills: Setting up and implementing projects, social skills (teamwork), transfer skills, independent processing of new methods, conflict management



## Submodule BIN-205-01 Software Engineering 2

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-SE2)   |
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS                                    |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 5   |
| <b>Suggestions for Independent Study</b>       | See literature  |
| <b>Recommended Prerequisites</b>               | Software Engineering 1  |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work |

### Learning Outcomes

Project management skills: Ability to plan, manage and control projects; knowing and being able to evaluate basic economic conditions and their effects; understanding HR management as a success factor  
Design skills: Ability to transfer a system concept into a productively functional implementation, understanding quality assurance and usability engineering as integral elements in the development project  
Technological skills: Sound knowledge in the selected subject area of software technology  
Interdisciplinary skills: Setting up and implementing projects, social skills (teamwork), transfer skills, independent processing of new methods, conflict management

### Content

Advanced design patterns, classical and agile software development processes, project management, quality management, usability engineering, other selected topics in the field of software technology

### Requirements for Contact Hours

Active participation, solving exercises

### Requirements for Independent Study Hours

Pre- and post-preparation of the content

### Bibliography

Grechenig, T., Bernhart, M., Breiteneder, R., Kappel, K.: Softwaretechnik, Pearson Studium.  
Gamma, E. R., Helm, R. Johnson, J. Vlissides: Design Patterns, Reading, MA, Addison Wesley.  
Balzert, H.: Lehrbuch der Softwaretechnik, Spektrum Akade. Verlag

## Module BIN-206 Practical Project 1

|  |   |
|--|---|
| <b>Level of Module</b>                         | Specific module                                   |
| <b>Type of Module</b>                          | Compulsory module                                 |
| <b>Submodules</b>                              | BIN-206-01 Practical Project 1, Compulsory        |
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr.                            |
| <b>ECTS Credits</b>                            | 10  |
| <b>Contact Hours / Independent Study Hours</b> | 300 h / 0 h                                       |
| <b>Semester</b>                                | 5   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All module examinations from 1st and 2nd semester |
| <b>Recommended Prerequisites</b>               | Specific to project                               |
| <b>Examination</b>                             | Experimental work                                 |

### Learning Outcomes

Analytical skills: Ability to independently analyze a given question using scientific methods and findings, ability to familiarize oneself with problems in different areas of application

Design/realization skills: Developing solution strategies and implementing them using the knowledge and skills acquired

Technological skills: Combining and specifically applying knowledge from different fields

Methodological skills: Ability to use different innovative methods to solve practical problems

Project management skills: Skills required for project planning, to set up an organizational structure and to steer projects

Social skills: Application of conflict-solving strategies, teamwork, communication

## Submodule BIN-206-01 Practical Project 1

|  |                        |
|--|------------------------|
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr. |
| <b>Language of Instruction</b>                 | German                 |
| <b>Curriculum Allocation</b>                   | BIN                    |
| <b>Course Type, Contact Hours per Week</b>     | Project, 8 SWS         |
| <b>ECTS Credits</b>                            | 10                     |
| <b>Contact Hours / Independent Study Hours</b> | 300 h / 0 h            |
| <b>Semester</b>                                | 5                      |
| <b>Suggestions for Independent Study</b>       | Specific to project    |
| <b>Recommended Prerequisites</b>               | Specific to project    |
| <b>Examination</b>                             | Experimental work      |

### Learning Outcomes

Analytical skills: Ability to independently analyze a given question using scientific methods and findings, ability to familiarize oneself with problems in different areas of application

Design/realization skills: Developing solution strategies and implementing them using the knowledge and skills acquired

Technological skills: Combining and specifically applying knowledge from different fields

Methodological skills: Ability to use different innovative methods to solve practical problems

Project management skills: Skills required for project planning, to set up an organizational structure and to steer projects

Social skills: Application of conflict-solving strategies, teamwork, communication

### Content

Working through a complex task in a practical field of application in a project group. The work is characterized by the project-specific organization, planning and execution. The project duration is usually two semesters.

### Requirements for Contact Hours

Active participation in project

### Requirements for Independent Study Hours

Solve tasks independently

### Bibliography

Specific to project

## Module BIN-207 Computer Graphics 2

|  |   |
|--|---|
| <b>Subheading</b>                              | Digital Image Processing (BIN-CG2)  |
| <b>Level of Module</b>                         | Basic module  |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-207-01 Computer Graphics 2, Compulsory  |
| <b>Person in Charge</b>                        | Ginkel, Ingo, Prof. Dr.   |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 5   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All module examinations from 1st to 2nd semester  |
| <b>Recommended Prerequisites</b>               | BIN-100 / BIN-105 / BIN-111<br>(Mathematics 1/2/3)<br>BIN-107 (Statistics)<br>BIN-200 (Computer Graphics 1) |
| <b>Examination</b>                             | Written or oral examination, experimental work  |

### Learning Outcomes

Algorithmic and mathematic competence: understanding basic algorithms of digital image processing.

Design competence: Selection and application of suitable methods for image enhancement in varying application scenarios and their realisation in hard- and software.

Interdisciplinary competence based on theoretical and practical experience gained by application of digital image processing methods in difference applications.

Social competences: Teamwork, presentation and discussion of proposed solutions for selected exercises.

## Submodule BIN-207-01 Computer Graphics 2

|  |   |
|--|---|
| <b>Subheading</b>                              | Digital Image Processing (BIN-CG2)  |
| <b>Person in Charge</b>                        | Ginkel, Ingo, Prof.Dr.  |
| <b>Language of Instruction</b>                 | German  |
| <b>Curriculum Allocation</b>                   | BIN   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 5   |
| <b>Suggestions for Independent Study</b>       | See Literature  |
| <b>Recommended Prerequisites</b>               | BIN-100 / BIN-105 / BIN-111<br>(Mathematics 1/2/3)<br>BIN-107 (Statistics)<br>BIN-200 (Computer Graphics 1) |
| <b>Examination</b>                             | Written or oral exam, experimental work   |

### Learning Outcomes

Algorithmic and mathematic competence: understanding basic algorithms of digital image processing.  
Design competence: Selection and application of suitable methods for image enhancement in varying application scenarios and their realisation in hard- and software.  
Interdisciplinary competence based on theoretical and practical experience gained by application of digital image processing methods in difference applications.  
Social competences: Teamwork, presentation and discussion of proposed solutions for selected exercises.

### Content

basic knowledge of internal structure and operation principle of digital image processing systems in practical applications,  
Basic concepts of digital images and their representation in position space and frequency domain, color models and color management, methods for image enhancement in position space and frequency domain,  
simple image segmentation algorithms  
implementation of image processing algorithms

### Requirements for Contact Hours

Active participation, solving exercises

### Requirements for Independent Study Hours

preparation and postprocessing of the lecture

### Bibliography

lecture slides,  
Burger, w., Burge, M.J.: Digitale Bildverarbeitung, x.media.press, Springer Verlag  
Gonzalez,R.C., Woods,R.E.: Digital Image Processing, Prentice Hall

## Module BIN-208 Practical Project 2

|  |  |
|--|--|
| <b>Level of Module</b>                         | Specific module                                  |
| <b>Type of Module</b>                          | Compulsory module                                |
| <b>Submodules</b>                              | BIN-208-01 Practical Project 2, Compulsory       |
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr.                           |
| <b>ECTS Credits</b>                            | 7  |
| <b>Contact Hours / Independent Study Hours</b> | 210 h / 0 h                                      |
| <b>Semester</b>                                | 6  |
| <b>Duration of Module</b>                      | 1 semester                                       |
| <b>Prerequisites</b>                           | All module examinations from 1st to 3rd semester |
| <b>Recommended Prerequisites</b>               | Specific to project                              |
| <b>Examination</b>                             | Experimental work                                |

### Learning Outcomes

Analytical skills: Ability to independently analyze a given question using scientific methods and findings, ability to familiarize oneself with problems in different areas of application

Design/realization skills: Developing solution strategies and implementing them using the knowledge and skills acquired

Technological skills: Combining and specifically applying knowledge from different fields

Methodological skills: Ability to use different innovative methods to solve practical problems

Project management skills: Skills required for project planning, to set up an organizational structure and to steer projects

Social skills: Application of conflict-solving strategies, teamwork, communication

## Submodule BIN-208-01 Practical Project 2

|  |                        |
|--|------------------------|
| <b>Person in Charge</b>                        | Bruns, Ralf, Prof. Dr. |
| <b>Language of Instruction</b>                 | German                 |
| <b>Curriculum Allocation</b>                   | BIN                    |
| <b>Course Type, Contact Hours per Week</b>     | Project, 6 SWS         |
| <b>ECTS Credits</b>                            | 7                      |
| <b>Contact Hours / Independent Study Hours</b> | 210 h / 0 h            |
| <b>Semester</b>                                | 6                      |
| <b>Suggestions for Independent Study</b>       | Specific to project    |
| <b>Recommended Prerequisites</b>               | Specific to project    |
| <b>Examination</b>                             | Experimental work      |

### Learning Outcomes

Analytical skills: Ability to independently analyze a given question using scientific methods and findings, ability to familiarize oneself with problems in different areas of application  
Design/realization skills: Developing solution strategies and implementing them using the knowledge and skills acquired  
Technological skills: Combining and specifically applying knowledge from different fields  
Methodological skills: Ability to use different innovative methods to solve practical problems  
Project management skills: Skills required for project planning, to set up an organizational structure and to steer projects  
Social skills: Application of conflict-solving strategies, teamwork, communication

### Content

Continuation of the Practical Project 1 module from the previous semester

### Requirements for Contact Hours

Active participation in project

### Requirements for Independent Study Hours

Solve tasks independently

### Bibliography

Specific to project

## Module BIN-209 Special Topics

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-EF)   |
| <b>Level of Module</b>                         | Specific module  |
| <b>Type of Module</b>                          | Compulsory module  |
| <b>Person in Charge</b>                        | Hovestadt, Matthias, Prof. Dr.                               |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 112 h / 68 h   |
| <b>Semester</b>                                | 4  |
| <b>Duration of Module</b>                      | 3 semester   |
| <b>Prerequisites</b>                           | All module examinations from 1st semester.                   |
| <b>Recommended Prerequisites</b>               | Depending on the specific subject                            |
| <b>Examination</b>                             | Written or oral examination, presentation, experimental work |

### Learning Outcomes

Students broaden their knowledge by building competencies in a general subject.  
(Varying courses are offered resp. can be accepted; three courses must be chosen, one of them being a course in business administration)



## Module BIN-210 Bachelor Thesis with Colloquium

|  |   |
|--|---|
| <b>Subheading</b>                              | (BIN-BAA)   |
| <b>Level of Module</b>                         | Specific module   |
| <b>Type of Module</b>                          | Compulsory module   |
| <b>Submodules</b>                              | BIN-210-01 Bachelor Thesis with Colloquium, Compulsory  |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.   |
| <b>ECTS Credits</b>                            | 15  |
| <b>Contact Hours / Independent Study Hours</b> | 0 h / 450 h   |
| <b>Semester</b>                                | 6   |
| <b>Duration of Module</b>                      | 1 semester  |
| <b>Prerequisites</b>                           | All modules of semesters 1 to 3 of BIN programme; at least 134 CP in BIN programme                    |
| <b>Recommended Prerequisites</b>               | All modules of semesters 4 and 5 in the chosen specialization, BIN-204 (BIN-BSEM), BIN-206 (BIN-BPR1) |
| <b>Examination</b>                             | Written thesis, colloquium  |

### Learning Outcomes

Analysis, design and realization skills: Ability to independently analyze and use scientific methods to treat a topic area from the group of subjects selected, conceiving and realizing solutions

Technological skills: Ability to select technologies from the chosen subject area and use them to solve the problem at hand  
Interdisciplinary skills: The topic selected may be worked through in cooperation with an industrial company; the conditions in that company are to be included in the solution

Methodological skills: Developing state-of-the-art knowledge on the topic chosen using scientific methods, ability to adapt and expand

known solutions for the given topic

Project management skills: Ability to complete the task in the time given, planning of the delegation of tasks required and keeping to the

time schedule, employing self organization and meeting deadlines

Personal skills: Ability to properly present the topic selected along with the solution developed, ability to answer specific questions on the topic, ability to discuss and assess alternative solutions

## Submodule BIN-210-01 Bachelor Thesis with Colloquium

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-BAA)  |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.  |
| <b>Language of Instruction</b>                 | by agreement   |
| <b>Curriculum Allocation</b>                   | BIN  |
| <b>Course Type, Contact Hours per Week</b>     | Final Thesis   |
| <b>ECTS Credits</b>                            | 15   |
| <b>Contact Hours / Independent Study Hours</b> | 0 h / 450 h  |
| <b>Semester</b>                                | 6  |
| <b>Suggestions for Independent Study</b>       | Scientific treatment of the individual topic, parallel work on subjects and thesis document, regular meetings and discussion of work with supervisor |
| <b>Recommended Prerequisites</b>               | All modules of semesters 4 and 5 in the chosen specialization, BIN-204 (BIN-BSEM), BIN-206 (BIN-BPR1)  |
| <b>Examination</b>                             | Written thesis, colloquium   |

### Learning Outcomes

Analysis, design and realization skills: Ability to independently analyze and use scientific methods to treat a topic area from the group of

subjects selected, conceiving and realizing solutions

Technological skills: Ability to select technologies from the chosen subject area and use them to solve the problem at hand  
Interdisciplinary skills: The topic selected may be worked through in cooperation with an industrial company; the conditions in that company are to be included in the solution

Methodological skills: Developing state-of-the-art knowledge on the topic chosen using scientific methods, ability to adapt and expand

known solutions for the given topic

Project management skills: Ability to complete the task in the time given, planning of the delegation of tasks required and keeping to the

time schedule, employing self organization and meeting deadlines

Personal skills: Ability to properly present the topic selected along with the solution developed, ability to answer specific questions on the topic, ability to discuss and assess alternative solutions

### Content

Self-contained work on an individual topic from applied computer science, preparation of a written thesis document, oral presentation and critical discussion of results; the topic should be selected in close cooperation with external enterprises

### Requirements for Contact Hours

None

### Requirements for Independent Study Hours

Self-contained scientific work, writing a thesis document, preparation and execution of a presentation

### Bibliography

Depends on specific topic

## Module BIN-211 Computer Graphics 3

|  |  |
|--|--|
| <b>Subheading</b>                              | Animation (BIN-CG3)                              |
| <b>Level of Module</b>                         | Specific module                                  |
| <b>Type of Module</b>                          | Optional module                                  |
| <b>Submodules</b>                              | BIN-211-01 Computer Graphics 3, Compulsory       |
| <b>Person in Charge</b>                        | Ginkel, Ingo, Prof. Dr.                          |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h                                     |
| <b>Semester</b>                                | 5  |
| <b>Duration of Module</b>                      | 1 semester                                       |
| <b>Prerequisites</b>                           | All module examinations from 1st to 2nd semester |
| <b>Recommended Prerequisites</b>               | BIN-200 (Computer Graphics 1)                    |
| <b>Examination</b>                             | Written or oral examination, experimental work   |

### Learning Outcomes

Algorithmic and mathematic competence: Exploring, using, evaluating and comparing methods and techniques for computer-based animation and simulation. Implementation and practical evaluation of different methods.

Communicative competence: Presentation and discussion of proposed solutions

## Submodule BIN-211-01 Computer Graphics 3

|  |   |
|--|---|
| <b>Subheading</b>                              | Animation (BIN-CG3)                     |
| <b>Person in Charge</b>                        | Ginkel, Ingo, Prof.Dr.                  |
| <b>Language of Instruction</b>                 | by agreement                            |
| <b>Curriculum Allocation</b>                   | BIN, MDI                                |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS            |
| <b>ECTS Credits</b>                            | 6                                       |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h                            |
| <b>Semester</b>                                | 5                                       |
| <b>Suggestions for Independent Study</b>       | See Literature                          |
| <b>Recommended Prerequisites</b>               | BIN-200 Computer Graphics 1 (BIN-CG1)   |
| <b>Examination</b>                             | Written or oral exam, experimental work |

### Learning Outcomes

Algorithmic and mathematic competence: Exploring, using, evaluating and comparing methods and techniques for computer-based animation and simulation. Implementation and practical evaluation of different methods.

Communicative competence: Presentation and discussion of proposed solutions

### Content

Principles of Computer Animation, Descripton of trajectories for camera movement using splines, Orientation in space and interpolation using quaternions, physically based animation using particle systems, mass-spring-systems, bounding boxes and space partitioning techniques, hierarchical animation, kinematic chains

### Requirements for Contact Hours

Active participation, solving exercises

### Requirements for Independent Study Hours

preparation and postprocessing of the lecture

### Bibliography

lecture slides,

Ericson,C.: Real-Time Collision Detection, Elsevier

Witkin,A.:Physically Based Modeling - Principles and Practice, Siggraph Course Notes

## Module BIN-212 Software Engineering 3

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-SE3)  |
| <b>Level of Module</b>                         | Specific module                                  |
| <b>Type of Module</b>                          | Optional module                                  |
| <b>Submodules</b>                              | BIN-212-01 Software Engineering 3, Compulsory    |
| <b>Person in Charge</b>                        | Koschel, Arne, Prof. Dr.                         |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h                                     |
| <b>Semester</b>                                | 5  |
| <b>Duration of Module</b>                      | 1 semester                                       |
| <b>Prerequisites</b>                           | All module examinations from 1st to 3rd semester |
| <b>Recommended Prerequisites</b>               | BIN-201 (BIN-SE1), BIN-203 (BIN-WT)              |
| <b>Examination</b>                             | Written or oral examination, experimental work   |

### Learning Outcomes

Technological skills: Having an understanding of the way in which distributed systems and applications work

Design skills: Knowing and being able to apply the basic construction principles of complex software architectures. Using suitable design patterns to develop distributed systems

Realization skills: Ability to configure and use complex infrastructures

## Submodule BIN-212-01 Software Engineering 3

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-SE3)  |
| <b>Person in Charge</b>                        | Koschel, Arne, Prof. Dr.   |
| <b>Language of Instruction</b>                 | by agreement   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Suggestions for Independent Study</b>       | See literature   |
| <b>Recommended Prerequisites</b>               | BIN-201 (BIN-SE1), BIN-203 (BIN-WT)<br>or<br>MDI-201 (MDI-SE1), MDI-203 (MDI-WT) |
| <b>Examination</b>                             | Written or oral examination, experimental work                                   |

### Learning Outcomes

- Technological skills: Having an understanding of the way in which distributed systems work, for example, distributed component based systems.
- Design skills: Knowing and being able to apply the basic construction principles of complex software architectures. Using suitable design patterns to develop distributed systems
- Realization skills: Ability to configure and use complex infrastructures

### Content

Basic concepts of software architectures, particularly for the development of distributed systems.

- The development of frameworks is presented on the basis of a simple persistence framework.
- Basic concepts of distributed systems, distributed software architectures, multi-layer architecture, middleware
- Implementation of distributed systems: sockets, RMI, MoM, Web services
- Architecture and development of Internet-based systems: Java EE (JSPs, EJBs etc.)
- potentially selected additional current topics in distributed systems

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

J. Dunkel, A. Holitschke: Softwarearchitektur für die Praxis, Springer Verlag  
G. Bengel: Grundkurs verteilte Systeme, vieweg  
M. Boger: Java in verteilten Systemen, dpunkt.verlag  
A. Eberhart, S. Fischer: Web Services, Hanser Verlag  
Current literature, e.g., on Java EE, Cloud C.

## Module BIN-213 Operating Systems and Networks 3

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-BSN3)   |
| <b>Level of Module</b>                         | Specific module  |
| <b>Type of Module</b>                          | Optional module  |
| <b>Submodules</b>                              | BIN-213-01 Operating Systems and Networks 3, Compulsory  |
| <b>Person in Charge</b>                        | Wohlfeil, Stefan, Prof. Dr.  |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 5  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | All module examination of 1st and 2nd semester.  |
| <b>Recommended Prerequisites</b>               | All modules of semesters 1, 2, and 3. Operating Systems and Networks 1 (BIN-BSN1), Operating Systems and Networks 2 (BIN-BSN2) |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work  |

### Learning Outcomes

Technological competencies: Architecture, functionality and implementation of operating systems and networks. Latest trends and technologies in this area. Analysis and implementation competencies: Students learn to evaluate the properties and application areas of these technologies.

## Submodule BIN-213-01 Operating Systems and Networks 3

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-BSN3)   |
| <b>Person in Charge</b>                        | Wohlfeil, Stefan, Prof. Dr.  |
| <b>Language of Instruction</b>                 | by agreement   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Suggestions for Independent Study</b>       | Practical exercises use a Linux environment. Students may use a virtual machine on their laptop. |
| <b>Recommended Prerequisites</b>               | All modules of semesters 1, 2, and 3. BIN-202 Operating Systems and Networks 2 (BIN-BSN2)        |
| <b>Examination</b>                             | Examination (written or oral examination) and experimental work                                  |

### Learning Outcomes

Technological competencies: Architecture, functionality and implementation of operating systems and networks. Latest trends and technologies in this area. Analysis and implementation competencies: Students learn to evaluate the properties and application areas of these technologies.

### Content

New trends and technologies in operating systems and computer Networks

### Requirements for Contact Hours

Preparation and postprocessing of all lectures and exercises. Notes-taking in lecture. Active participation.

### Requirements for Independent Study Hours

Study all provided material; deepen knowledge using additional literature; successfully work on all exercises

### Bibliography

provided by lecturer



## Module BIN-214 Database Systems 3

|  |  |
|--|--|
| <b>Level of Module</b>                         | Specific module                                |
| <b>Type of Module</b>                          | Optional module                                |
| <b>Submodules</b>                              | BIN-214-01 Database Systems 3, Compulsory      |
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.                    |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h                                   |
| <b>Semester</b>                                | 5  |
| <b>Duration of Module</b>                      | 1 semester                                     |
| <b>Prerequisites</b>                           | All modules of semester 1 and 2 of BIN course  |
| <b>Recommended Prerequisites</b>               | BIN-113  |
| <b>Examination</b>                             | Written or oral examination, experimental work |

### Learning Outcomes

Formal and algorithmic skills: Knowledge and implementation competency of modeling techniques for database systems, knowledge and judgement competency of processing, execution and optimization of database queries, knowledge and application competency of standard as well as novel data organization strategies in database systems

Analysis, design and implementation skills: Knowledge, application and implementation of principles of data logging and recovery as well as database optimization

Technological skills: knowledge of internal organization and memory management of database systems, knowledge and application of methods for transaction integrity, knowledge and application of novel relational database's internal memory organization

## Submodule BIN-214-01 Database Systems 3

|  |   |
|--|---|
| <b>Person in Charge</b>                        | Kleiner, Carsten, Prof. Dr.   |
| <b>Language of Instruction</b>                 | by agreement  |
| <b>Curriculum Allocation</b>                   | BIN, MDI  |
| <b>Course Type, Contact Hours per Week</b>     | Lecture with exercise, 4 SWS  |
| <b>ECTS Credits</b>                            | 6   |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h  |
| <b>Semester</b>                                | 5   |
| <b>Suggestions for Independent Study</b>       | Work on slides and literature, reflection and self-contained application of content |
| <b>Recommended Prerequisites</b>               | BIN-113 (BIN-DBS2) or MDI-221 (MDI-DBS2), BIN-109 or MDI-202                        |
| <b>Examination</b>                             | Written or oral examination, experimental work                                      |

### Learning Outcomes

Formal and algorithmic skills: Knowledge and implementation competency of modeling techniques for database systems, knowledge and judgement competency of processing, execution and optimization of database queries and according algorithms, knowledge and application competency of standard as well as novel data organization strategies in database systems

Analysis, design and implementation skills: Knowledge, application and implementation of principles of data logging and recovery as well as database optimization

Technological skills: knowledge of internal organization and memory management of database systems, knowledge and implementation skills for database recovery operations, knowledge and application of novel relational database's internal memory organization

### Content

Internal database and memory organization, processing, execution and optimization of database queries, effort estimation for query execution, query execution algorithms, backup and recovery of database systems, novel relational database memory organization (main memory, column-oriented, parallel query execution)

### Requirements for Contact Hours

Lecture: Following presentations and examples, discussion, following executions and visualizations in learning software, reflection of content, self-contained application of subjects

Exercise: Self-contained work on problems on paper and by using learning software, theoretical problems, presentation of problem solutions and project results

### Requirements for Independent Study Hours

Preparation and post-processing of lectures and exercises, self-contained work on problems, turning in homework in small groups, self-contained work on a project task in small groups, exam preparation, reading literature

### Bibliography

R. Elmasri, S. Navathe: Grundlagen von Datenbanksystemen, Pearson Studium

T. Härder, E. Rahm: Datenbanksysteme. Konzepte und Techniken der Implementierung, Springer

## Module BIN-215 Parallel Programming

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-PAR)  |
| <b>Level of Module</b>                         | Specific module  |
| <b>Type of Module</b>                          | Optional module  |
| <b>Submodules</b>                              | BIN-215-01 Parallel Programming, Compulsory  |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 5  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | All module examinations from 1st to 2nd semester   |
| <b>Recommended Prerequisites</b>               | BIN-102 Introduction to Programming (BIN-PR1), BIN-108 Object-oriented Programming (BIN-PR2) |
| <b>Examination</b>                             | Written or oral examination, experimental work   |

### Learning Outcomes

Technological skills:

Students are able to use the core means of the Java programming language and its library for the development of parallel applications.

Design, implementation and methodic skills:

Students can decompose applications into concurrent parts; can recognize and avoid data races, deadlocks and unnecessary performance bottlenecks; can distinguish programming models with and without shared data.

## Submodule BIN-215-01 Parallel Programming

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-PAR)  |
| <b>Person in Charge</b>                        | Peine, Holger, Prof. Dr.   |
| <b>Language of Instruction</b>                 | by agreement   |
| <b>Curriculum Allocation</b>                   | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>     | Lecture, 4 SWS   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 5  |
| <b>Suggestions for Independent Study</b>       | See literature   |
| <b>Recommended Prerequisites</b>               | BIN-102 Introduction to Programming (BIN-PR1) or MDI-102 Introduction to Programming (MDI-102), BIN-108 Object-oriented Programming (BIN-PR2) or MDI-109 Object-oriented Programming (MDI-109) |
| <b>Examination</b>                             | Written or oral examination, experimental work   |

### Learning Outcomes

Technological skills:

Students are able to use the core means of the Java programming language and its library for the development of parallel applications.

Design, implementation and methodic skills:

Students can decompose applications into concurrent parts; can recognize and avoid data races, deadlocks and unnecessary performance bottlenecks; can distinguish programming models with and without shared data.

### Content

Processes and threads, data races, data consistency, concurrency, causal dependency,(conditional) critical sections, visibility, semaphores, deadlocks, nonblocking synchronisation, structuring as concurrent tasks and other design patterns, actor model, parallelization by compilers, cluster programming

### Requirements for Contact Hours

Active participation, solving exercise problems

### Requirements for Independent Study Hours

Preparation and postprocessing of the lectures, reading literature

### Bibliography

Urs Gleim, Tobias Schüle: Multicore-Software, dpunkt 2012

Brian Goetz: Java Concurrency in Practice, Addison -Wesley 2006

Thomas Rauber, Gudula Rünger: Multicore -Parallele Programmierung, Springer 2008

Peter S. Pacheco: Parallel programming with MPI, Kaufmann 199

## Module BIN-216 Current Aspects of Computer Science

|  |  |
|--|--|
| <b>Subheading</b>                              | (BIN-AAI)  |
| <b>Level of Module</b>                         | Specific module  |
| <b>Type of Module</b>                          | Optional module  |
| <b>Submodules</b>                              | BIN-216-01 Current Aspects of Computer Science, Compulsory |
| <b>Person in Charge</b>                        | Salzwedel, Jussi, M. Sc.                                   |
| <b>ECTS Credits</b>                            | 6  |
| <b>Contact Hours / Independent Study Hours</b> | 68 h / 112 h   |
| <b>Semester</b>                                | 5  |
| <b>Duration of Module</b>                      | 1 semester   |
| <b>Prerequisites</b>                           | All module examinations from 1st to 2nd semester           |
| <b>Recommended Prerequisites</b>               | All required modules from semesters 1 through 5            |
| <b>Examination</b>                             | Written or oral examination, experimental work             |
| <b>Learning Outcomes</b>                       | Specific to topic  |

## Submodule BIN-216-01 Current Aspects of Computer Science

|   |  |
|---|--|
| <b>Subheading</b>                               | (BIN-AAI)  |
| <b>Person in Charge</b>                         | Salzwedel, Jussi, M. Sc.   |
| <b>Language of Instruction</b>                  | by agreement   |
| <b>Curriculum Allocation</b>                    | BIN, MDI   |
| <b>Course Type, Contact Hours per Week</b>      | Lecture, 4 SWS   |
| <b>ECTS Credits</b>                             | 6  |
| <b>Contact Hours / Independent Study Hours</b>  | 68 h / 112 h   |
| <b>Semester</b>                                 | 5  |
| <b>Suggestions for Independent Study</b>        | Specific to topic  |
| <b>Recommended Prerequisites</b>                | All required modules from semesters 1 through 5                    |
| <b>Examination</b>                              | Written or oral examination, experimental work                     |
| <b>Learning Outcomes</b>                        | Specific to topic  |
| <b>Content</b>                                  | An advanced topic in computer science of current interest          |
| <b>Requirements for Contact Hours</b>           | Active participation, solving exercise problems                    |
| <b>Requirements for Independent Study Hours</b> | Preparation and postprocessing of the lectures, reading literature |
| <b>Bibliography</b>                             | Specific to topic  |