## Module description: Algorithms and Data Structures

| | |
|---|---|
| **Module Code** | t.BA.IT.ADS.13HS |
| **ECTS Credits** | 4 |
| **Language of Instruction/Examination** | German |
| **Organizational Unit** | InIT |
| **Module Coordinator** | Jürgen Spielberger |
| **Legal Framework** | The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail. |
| **Module Characteristic** | Type 3a<br><br>2 lecture lessons per semester week and class+ 2 lab bi-weekly lessons per semester and half-class |
| **Module Description** | The module covers basic algorithms and data structures in computer science. In particular, students learn - Know and practise the approach used for algorithmically complex problems. - They know the central data structures of computer science and how they are implemented in Java. - They will be able to estimate the computational effort. - They learn to apply basic design patterns. |
| **Module Content** | **General concepts - Asymptotic complexity (O-notation) - Analysis of algorithms (runtime and storage space)**<br><br>**Algorithm Paradigms - Recursion - Backtracking - Greedy algorithms - Divide and Conquer**<br><br>**Data Structures - Stack and Queue - List - Hash table - Trees - Graphs**<br><br>**Algorithms - Searching - Tree traversing - Rotation in balanced search trees - Hash Tables - Shortest paths in graphs - Width and depth search in graphs - Sorting algorithms - Runtime requirements**<br><br>**Algorithms in Java - Objects/equals/hashCode - Comparator/Comparable - Collections - Generics - Iterator** |
| **Prerequisite Knowledge** | • **THIN**: Theoretical Computer Science, especially Runtime (P/NP) and O-Notation<br>• **PROG1, PROG2**: Programming in Java<br>• **Discrete mathematics**: Fundamentals Discrete mathematics |

| **Learning Objectives (Competences)** | Students... | Competencies | Taxonomies |
|---|---|---|---|
| | Students can implement and use algorithms and data structures in Java. | F | K3 |
| | The students know the central algorithms and data structures of computer science. | F | K1 |
| | Students can estimate the computational effort of simple algorithms. | F, M | K3 |
| | Students know basic design patterns for designing new algorithms and can apply them to simple problems. | M, F | K1, K3 |

# Module description: Algorithms and Data Structures

| Performance Assessment | **End-of-module exam** | **Assessment** | **Length (min.)** | **Weighting** | **Form** |
|---|---|---|---|---|---|
| | oral exam | Grade | 20 | 70 | acc. to module agreement |

| | **Performance assessment during the semester** | **Assessment** | **Length (min.)** | **Weighting** | **Form** |
|---|---|---|---|---|---|
| | Praktika | Grade | | 30 | acc. to module agreement |

| Classroom Attendance Requirement | None |
|---|---|
| Learning material | • Slides<br>• Practical exercise |
| Comments | Supplementary literature:<br><br>• Saake/Sattler: "Algorithmen und Datenstrukturen: Eine Einführung mit Java"<br>• 5. überarbeitete Auflage 2014, dPunkt Verlag, ISBN 978-3-86490-136-2<br>• Sedgewick/Wayne: "Algorithmen: Algorithmen und Datenstrukturen"<br>• 4. aktualisierte Auflage 2014, Pearson Education, ISBN: 978-3-86894-184-5<br>• Weitere Unterlagen werden bei Bedarf zur Verfügung gestellt. |