SYLLABUS
COURSE DESCRIPTION

COURSE TITLE	Data Structures and Algorithms
COURSE CODE	75003
SCIENTIFIC SECTOR	INF/01
DEGREE	Bachelor in Computer Science and Engineering
SEMESTER	2nd Semester
YEAR	1st
CREDITS	8

TOTAL LECTURING HOURS	48
TOTAL LAB HOURS	24
PREREQUISITES	• Java programming skills at an introductory level • Basic mathematical knowledge about sets, functions, and elementary calculus
COURSE PAGE	https://ole.unibz.it/

SPECIFIC EDUCATIONAL OBJECTIVES	• Type of course: “di base” for L-31 and L-08 • Scientific area: “formazione informatica di base” for L-31 and “matematica, informatica e statistica” for L-8 By following this course, students will be able to formulate algorithmic problems and to recognize algorithmic problems underlying an application. They will also acquire an in-depth understanding of the standard data structures and the corresponding algorithmic techniques to solve such problems. They will recognize how certain algorithmic approaches depend on the choice of a suitable data structure and vice versa. Moreover, students will learn how to analyze whether an algorithm is correct and which time and space resources it needs. Finally, students will learn how to compare different algorithms with respect to their suitability for a given application.

LECTURER	Werner Nutt, Lecture’s page: http://www.inf.unibz.it/~nutt/
SCIENTIFIC SECTOR OF THE LECTURER	INF/01
TEACHING LANGUAGE	English

OFFICE HOURS	Office POS 2.09, Faculty of CS, POS Building, piazza Domenicani 3, werner.nutt@unibz.it +39 0471 01612
TEACHING ASSISTANT	David Blumenthal: DBlumenthal@unibz.it Florian Hofer: Florian.Hofer@unibz.it Daniele Porello: Daniele.Porello@unibz.it
OFFICE HOURS	David Blumenthal: Thursday, 15:00-16:00, office POS 2.12, Faculty of CS, piazza Domenicani 3; Florian Hofer: Wednesday and Thursday, 13:00-14:00, office POS 1.04, Faculty of CS, piazza Domenicani 3; Daniele Porello: Wednesday, 18:00, office POS 3.03, Faculty of CS, piazza Domenicani 3;
LIST OF TOPICS COVERED	• Introduction to computation models • Principles of computability • Role of data structures and algorithms • Analysis of data structures • Trees and linked lists • Analysis of algorithms and their complexity • Searching and sorting • Graphs and associated algorithms
TEACHING FORMAT	Frontal lectures, exercise groups supported by teaching assistants (TAs), and weekly coursework assignments that are corrected and commented by the TAs. In the lectures, new concepts and techniques are presented. In the assignments, students refine these in order to apply them to selected problems. They also measure the actual performance of their implementations and compare it with the theoretical predictions. In the exercise groups, students discuss possible approaches to the tasks of the assignments with the TAs and compare different approaches taken. In the exercise groups, students also solve small problems that are independent of the assignments to deepen the understanding of the material presented in the lectures

LEARNING OUTCOMES	**Knowledge and understanding** • Know the concepts of complexity of algorithms and data structures • Have a solid knowledge of the most important data structures and programming techniques • Have a solid knowledge of the most important algorithms for sorting and searching and their complexity **Applying knowledge and understanding** • Be able to analyze and measure size, complexity and critical aspects of algorithms and data structures **Ability to make judgments** • Be able to collect useful data and to judge information systems and their applicability **Communication skills** • Be able to structure and write scientific documentation **Ability to learn** • Be able to learn cutting edge IT technologies and their strengths and limitations

ASSESSMENT	The assessment is based on coursework assignments, a written midterm exam, and a written final exam. The assignments consist of exercises to apply knowledge acquired in the lectures and experiments, on which the students have to report. The written exams consist of questions to verify knowledge, questions that assess the ability to apply knowledge acquired in the course, and small exercises. The coursework and midterm are optional (for the weighting and calculation of final mark, see below). The marks are valid during the three exam sessions following the teaching of the course.
ASSESSMENT LANGUAGE	English
EVALUATION CRITERIA AND CRITERIA FOR AWARDING MARKS	In the coursework exercises students have to develop solutions for algorithmic problems and analyze their solutions with respect to correctness and running time. The exercises are assessed according to correctness and efficiency and validity of the analysis. In experiments, students have to implement variants of algorithms and identify under which conditions which variant performs best. The experiments are assessed according to the suitability of the design of the experiment, the appropriateness of the measurements taken, and the validity of the conclusions drawn. In the written exams, students have to apply techniques taught in the course in a defined setting and have to develop algorithms for new problems. The algorithms developed have to be analyzed with respect to correctness and efficiency. The answers are marked according to their correctness, the suitability of the algorithms developed, and the validity and clarity of the analysis. Students who do not submit all assignments or do not take part in the midterm exam will be assessed on the exams taken and the submitted parts of the coursework. For students who take the midterm and submit all assignments, the final mark will be a weighted average of the exam mark (40%), the midterm mark (20%) and the assignment mark (40%). If students do not submit all assignments or do not take the midterm, the percentage for assignments and midterm will be lower. Also, assignments for which the mark is lower than the mark of the written exam will not be considered. The same holds for the midterm exam.

REQUIRED READINGS	Textbook: *Introduction to Algorithms,* Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein (CLRS), 2nd or 3rd edition University Library: ST 134 C811
SUPPLEMENTARY READINGS	Suggestion for further reading: *Algorithms and Data Structures - The Basic Toolbox*, K. Mehlhorn and P. Sanders, free download from http://www.mpi-inf.mpg.de/~mehlhorn/ftp/Mehlhorn-Sanders-Toolbox.pdf
SOFTWARE USED	Java