COURSE DESCRIPTION – ACADEMIC YEAR 2018/2019

Course title	**Algorithms for Data Processing**
Course code	73010
Scientific sector	INF/01
Degree	Master in Computational Data Science (LM-18)
Semester	1
Year	1
Credits	6
Modular	No

Total lecturing hours	40
Total lab hours	20
Attendance	Attendance is not compulsory, but recommended.
Prerequisites	There are no formal prerequisites in terms of courses to attend. On the other hand, we assume that students are able to write programs that implement basic algorithms by manipulating data structures such as trees and graphs, and apply basic data structures such as arrays, lists, queues, and stacks.
Course page	https://ole.unibz.it/ and http://www.inf.unibz.it/~artale/ADP/adp.htm

Specific educational objectives	The course belongs to the type "caratterizzanti – discipline informatiche" in the curriculum "Data Management". The aim of the course is to provide students with the fundamental skills needed to develop algorithms using data structures and analyze their correctness and efficiency, so that they will be able to • design programs that use computer resources efficiently, • realize that there are problems that are impractical or even impossible to solve by a computer. The course is devoted to identify clean algorithmic problem formulations in complex issues from different areas of computing and, from this, how to design efficient algorithms for the resulting problems. The students will be trained to apply algorithms mainly to process Graphs. The notions of computability and complexity will let the students acquire a strong formal tool to recognize when a problem is inherently complex independently of any algorithm developed to solve the problem. Since so many natural problems in computer science are NP-complete, the development of methods to deal with intractable problems has become a crucial issue in the study of algorithms. Thus, the course presents various solutions to tackle inherently complex problems by either designing an exact algorithm or try to approximate the problem or to find a randomized technique.

Lecturer	Alessandro Artale
Contact	Office: POS 2.03 Faculty of CS, POS Building, Piazza Domenicani 3, Web Page: http://www.inf.unibz.it/~artale Email: artale@inf.unibz.it
Scientific sector of lecturer	INF/01

Teaching language	English
Office hours	During the lecture time span, Office 2.03. To fix an appointment email at artale@inf.unibz.it
Lecturing Assistant (if any)	Alessandro Artale
Contact LA	
Office hours LA	During the lecture time span, Office 2.03. To fix an appointment email at artale@inf.unibz.it
List of topics	• Principles for the construction of algorithms applied to graph algorithms • Computability and complexity of problems • NP-complete problems (Cook theorem) • Exact algorithms for NP problems • Approximation algorithms for NP problems • Randomized algorithms: Does randomness help solving NP problems?
Teaching format	Frontal lectures, exercises in lab

Learning outcomes	Knowledge and understanding: • D1.1 - Knowledge of the key concepts and technologies of data science disciplines • D1.3 - Knowledge of principles, methods and techniques for processing data in order to make them usable for practical purposes, and understanding of the challenges in this field • D1.11 - Knowledge of the main algorithms for data analysis, and of elements of the complexity theory Applying knowledge and understanding: • D2.2 - Ability to address and solve a problem using scientific methods Making judgments • D3.2 - Ability to autonomously select the documentation (in the form of books, web, magazines, etc.) needed to keep up to date in a given sector. Communication skills • D4.1 - Ability to use English at an advanced level with particular reference to disciplinary terminology. Learning skills • D5.3 - Ability to deal with problems in a systematic and creative way and to appropriate problem solving techniques.

Assessment	Written exam. In the written exam there will be verification questions, transfer of knowledge questions and exercises. The learning outcome related to knowledge and understanding, applying knowledge and understanding and those related to the student ability to learn and the acquired learning skills will be assessed by the written exam.
Assessment language	English

Assessment Typology	Monocratic
Evaluation criteria and criteria for awarding marks	Final Written Exam 100% Written exam questions will be evaluated in term of correctness, clarity of answer, quality of argumentation, problem solving ability.

Required readings	**Algorithm Design.** Jon Kleinberg and Éva Tardos. Publisher: Pearson, 2005. Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it
Supplementary readings	
Software used	NA