## **Databases**

## Prof. Eugenio Tacchini

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course covers the fundamental concepts related to relational databases and relational database management systems. It includes a theoretical part, mainly focused on the relational model, database design methodologies and query languages and an experimental part in which students can practice with database design, SQL and the development of simple database-driven applications.

At the end of the course, students will be able to:

• Design a relational database (conceptual, logical and physical design) to satisfy the information needs of an organization.

• Normalize the schema of an existent relational database.

• Execute SQL queries on a relational database.

• Create simple triggers and stored procedures in a MySQL environment.

• Create simple, database-driven, Web applications in a PHP/MySQL environment.

***COURSE CONTENT***

Introduction to Information Systems and databases.

The relational model

* Represent information using relations
* Keys, domain and tuple constraints, referential integrity constraints

Elements of relational algebra

* Operators: union, intersection, difference, select, join

The SQL language

* Data definition, select queries (simple, using JOIN, with aggregate and group operators, nested), data modification
* Definition of integrity constraints
* Transactions
* Views
* Definition of triggers and procedures

Database design

* Conceptual design (extended E-R model)
* Logical design: translation of an E-R schema into a relational schema
* Physical design: database and storage media, data types, indexes.

Database normalization: first, second and third NF, BCNF.

Introduction to big data and NoSQL database.

Development of Web, database-driven, applications

* MySQL presentation
* Basic elements of HTML
* The PHP language: basic syntax, variables, expressions, flow control, interaction with MySQL (connection, execution of queries, use of a recordset in a Web page)

***READING LIST***

Atzeni et al.: *Basi di dati.* McGraw-Hill, 5a ed., 2018.

Course slides and notes.

Additional teaching material can be provided during the course.

***TEACHING METHODS***

Lectures and computer laboratory lessons.

***ASSESSMENT METHOD AND CRITERIA***

Students will be graded on the basis of a final exam and a project work assignment. The compulsory assignment (to be completed in groups of maximum three students) needs to be passed within given deadlines to be allowed to take the final exam. The final exam consists of two parts: a written test (it consists of a database design exercise and some SQL exercises) and an oral discussion (it consists of questions related to the course's program). During the oral discussion, the student also discusses the project assignment and the written test; the discussion could increase or decrease the grade obtained in the written test or in the project assignment. The final grade is computed as a weighted average of project assignment (25%), written exam (30%) and oral exam (45%).

The correctness and relevance of answers and the appropriate use of terminology will count towards the assessment of the final examination.

***NOTES AND PREREQUISITES***

Attendance at the course, although not compulsory, is recommended.

The course does not require any prerequisites in terms of content; however, being familiar with some basic IT concepts may facilitate understanding of the topics covered.

*Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.*