
DEGREE CURRICULUM

# DATABASES

Coordination: OLIVA SOLE, MARTA

Academic year 2022-23

# DATABASES 2022-23

## Subject's general information

<table>
<tr><td>Subject name</td><td>DATABASES</td></tr>
<tr><td>Code</td><td>102016</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Computer Engineering</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Double bachelor's degree: Degree in Computer Engineering and Degree in Business Administration and Management</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Master's Degree in Informatics Engineering</td><td></td><td>COMPLEMENTARY TRAINING</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>3</td><td>3</td></tr>
<tr><td>Number of groups</td><td>2</td><td>2</td></tr>
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<tr><td>Coordination</td><td>OLIVA SOLE, MARTA</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>6 ECTS = 25x6 = 150 working hours<br>40 % -> 60 classroom hours<br>60 % -> 90 hours of autonomous work of the student</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Aitor Corchero - Espanish<br>Marta Oliva - Catalan<br>Alvaro Ortega - Catalan</td></tr>
</table>

# DATABASES 2022-23

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|---|---|---|---|
| ARIÑO CAGIGÓS, RAÚL | raul.arino@udl.cat | 5 | |
| CORCHERO RODRIGUEZ, AITOR | aitor.corchero@udl.cat | 6 | arrange by email |
| OLIVA SOLE, MARTA | marta.oliva@udl.cat | 1 | arrange by email |

## Subject's extra information

It is based on the knowledge acquired in the courses: Estructures de Dades and Programació 2. Specifically, it is necessary to have assimilated the concepts related to structures for the persistent storage (files).

Course taught in the 1st semester of 2nd year of the program. It is part of the Matter "Anàlisi i Disseny d'Aplicacions" in the module "Formació Comú a la branca d'Informàtica". It introduces students to the Database technology as usual mechanism for the management, handling and storage of information, focusing on the relational model. The knowledge acquired in this course will be applicable in most careers, especially those who are dedicated to developing applications.

## Learning objectives

- Use a relational database manager.
- Understand database technology as the usual mechanism to manage, manipulate and store information.
- Manage a database in a relational manager.
- Understand the functional structure of a Relational Database Management System.
- Design a database according to user needs.
- Build statements to manipulate databases based in the SQL standard.
- Build sentences for accessing databases based in the SQL standard.
- Optimize a database according to user needs.
- Understanding the user needs of information storage.

## Competences

**Cross-disciplinary competences**

EPS11. Capacity to understand the needs of the user expressed in a no technical language.

**Specific competences**

GII-CRI2. Capacity to plan, conceive, deploy and direct projects, services and computer systems in all the fields, leading his set up and his continuous improvement and evaluation his economic and social impact.

GII-CRI12. Knowledge and application of the characteristics, functionalities and structure of the databases, that allow their suitable use, and the design and the analysis and implementation of applications based in them.

GII-CRI13.Knowledge and application of the necessary tools for the storage, processing and access to the

Systems of information, including those based in web.

GII-CRI16. Knowledge and application of the principles, methodologies and life cycle of the software engineering.

GII-CRI17. Capacity to design and evaluate person-computer interfaces that guarantee the accessibility and usability of systems, services and computer applications.

## Subject contents

**1. Introducction**

1.1. Concepte de Base de Dades
1.2. Objectius de les Bases de Dades
1.3. Arquitectura d'un Sistema de Bases de Dades
1.4. Independència de les dades
1.5. L'administrador de bases de dades. Diccionari de dades.
1.6. Evolució dels Sistemes de Bases de Dades

**2. The relational model**

2.1. Descripció del model
2.2. Àlgebra relacional
2.3. Càlcul relacional
2.4. Un petit exemple

**3. SQL (DDL,DML)**

3.1. L'estàndard SQL
3.2. Sentències de definició
3.3. Sentències de manipulació
3.4. Sentències de control
3.5. Llenguatge procedural
3.6. Optimització de consultes

**4. Normalization**

4.1. Anomalies en un esquema de BD.
4.2. Primera forma normal (1FN).
4.3. Dependències funcionals.
4.4. Segona forma normal (2FN).
4.5. Tercera forma normal (3FN).
4.6. Forma normal Boyce-Codd (FNBC).

**5. Conceptual and logical design**

5.1. Introducció.
5.2. Classes i atributs.
5.3. Interrelacions.
5.4. Altres.
5.5. Traducció dels diagrames de classes d'UML al model relacional.

**6. Components of a DBMS**

6.1. Arquitectura funcional d'un SGBD.
6.2. Processador de Vistes
6.3. Integritat
6.4. Gestor de Concurrència
6.5. Gestor de Dades

**7. Physical design**

7.1. Introducció.
7.2. Factors que influeixen en el disseny físic.
7.3. Decisions de disseny físic.
7.4. Ajustament de la BD en operació.

## Methodology

The course is structured in two Class Groups to ensure that the groups are not too large. Each student has to follow the sessions of the group assigned to her/him.

**Face-to-face class sessions (6 credits), which include theoretical content and problems/practices:**

- Lecture: classes based on notes and transparencies where the concepts of the subject will be presented.
- Problems: The concepts of the subject will work through a series of exercises to be resolved collaboratively.
- Some exercises are previously proposed by the teachers and the students have to prepare them.
- We analyze the pros and cons of the solutions provided by the students.
- There are lab sessions planned to work with the PostgreSQL database management system.

**Autonomous work (No Presential)**

- Study of teaching materials and resolution of proposed problems.
- The homework exercises and practices will be completed outside of class time.

## Development plan

| Week | Description | GG Theory Activity | GG Problems Activity | Autonomous Work |
|---|---|---|---|---|
| 1 | Presentation Introducction, relational model | Presentation of the subject T1: Introducction, T2: relational model | PostgreSQL working environment | Study related teaching materials, resolution of SQL exercises |
| 2 | Relational model, SQL | T2: Relational model, T3: SQL | SQL-DDL (DDL y INSERT,DELETE, UPDATE) | Study related teaching materials, resolution of SQL exercises |
| 3 | Relational model, SQL | T2: Relational model, (Relational algebra) T3: SQL | SQL-DML (SELECT) | Study related teaching materials, resolution of SQL exercises |
| 4 | Normalization | T4: Normalization | SQL-DML (SELECT) | Study related teaching materials, resolution of SQL exercises |
| 5 | Normalization | T4: Normalization (exercises) | SQL-DML (SELECT) | Study related teaching materials, resolution of SQL exercises |
| 6 | Conceptual and logical design | T5: Conceptual and logical design, Class diagrams | SQL-DDL, SQL-DML (TRANSACTION, LOCK, GRANT REVOKE) | Study related teaching materials, resolution of SQL exercises |
| 7 | Conceptual and logical design | T5: Conceptual and logical design, Class diagrams, translation | Advanced SQL / Functions and Triggers | Study related teaching materials, resolution of SQL exercises |
| 8 | Conceptual and logical design | Example of a UML case | UML Exercises-Translation | Study related teaching materials, resolution of SQL exercises |
| 9 | | First partial exam | | Prepare the exam |

| | | | | |
|---|---|---|---|---|
| 10 | Conceptual and logical design | UML | UML, SQL | Study related teaching materials, resolution of conceptual design exercises, using UML class diagrams, and SQL execises |
| 11 | Conceptual and logical design | UML | UML, SQL | Study related teaching materials, resolution of conceptual design exercises, using UML class diagrams, and SQL execises |
| 12 | DBMS Components | T6: DBMS Components, integrity | UML, SQL | Study related teaching materials, resolution of conceptual design exercises, using UML class diagrams, and SQL execises |
| 13 | DBMS Components | T6: Transaction management, concurrency management | UML, SQL | Study related teaching materials, resolution of conceptual design exercises, using UML class diagrams, and SQL execises |
| 14 | DBMS Components | T6: Transaction management, concurrency management | Transaction management, concurrency management exercises | Study related teaching materials, resolution of transaction management and concurrency management exercises |
| 15 | Physical Design | T7: Physical design | Transaction management, concurrency management exercises | Study related teaching materials, resolution of transaction management and concurrency management exercises |
| 16 | | | | Prepare the exam |
| 17 | | Second partial exam | | Prepare the exam |
| 18 | | | | Prepare the exam (if required) |
| 19 | | Recovery | | Prepare the exam (if required) |

## Evaluation

| Acr. | Evaluation Activities | Weight | Minimum Note | Week | In group | Mandatory | Recoverable |
|---|---|---|---|---|---|---|---|
| P1 | Partial 1 | 40% | NO | 9 | NO | SI | SI |
| P2 | Partial 2 | 40% | NO | 16-17 | NO | SI | SI |
| Pr1 | SQL Project | 10% | NO | 6-7 | SI (=4) | NO | NO |
| E1 | Design exercise | 10% | NO | 14 | SI (=4) | NO | NO |

| For class participation and for SQL-DML exercises in PostgreSQL environment delivered, can earn up to a maximum of 0.5 added to the final score. ( EndNote maximum : 10 points) |
|---|
| **EndNote** = 0,4*P1 + 0,4*P2 + 0,1*Pr1 + 0,1*E1 |

## Bibliography

Garcia-Molina H., Ullman J. D., Widom J. *Database Systems. The Complete Book*. 2nd edition. Pearson Education Inc. 2009.

Date C.J. Date C.J. *An Introduction to Database Systems* (Eighth Edition). Pearson. 2003.

Database Language SQL (1992). Document ISO/IEC 9075:1992. International Organization for Standardization (ISO).

Database Language SQL (1992). Document ANSI/X3 135-1992. American National Standards Institute (ANSI).