Universitat Autònoma de Barcelona

2019/2020

Relational Databases

Code: 104394
ECTS Credits: 6

Degree	Type	Year	Semester
2503740 Computational Mathematics and Data Analytics	OB	2	1

Contact

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Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Prerequisites

It is recommended that the student has knowledge and skills of:

- Structured programming
- Basic data structures.

These concepts correspond to content of the subjects:

- Initialization to programming

Objectives and Contextualisation

This course introduces the basic concepts of Databases (DB) needed both at the level of DB designer and user. At the end of the course the student must be able to:

• Know and understand the important technological leap represented by the Database systems and the Relational Databases (RDB) in particular, in terms of computer information processing, as well as in the design and maintenance of information processing applications.

• Know the architecture of the RDB systems, the functions of each module and the personnel that works in these systems (users, programmers and DB administrators). The architecture is studied from a local and remote point of view.

• Know the Entity/Relationship (E/R) model, widely used in RDB design.

• Study the properties of the relational model of DB, extended in the majority of DB engines.

• Know and know how to apply the SQL language, standard in RDB.

• Understand the DB design methodology, including the normalization techniques of a RDB.

• Know the main data structures used in RDB, such as indexing and hashing functions.

Competences

- Design, develop, maintain and evaluate software systems that allow large volumes of heterogeneous data to be represented, stored and handled in accordance with the established requirements.
- Make effective use of bibliographical resources and electronic resources to obtain information.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Using criteria of quality, critically evaluate the work carried out.
- Work cooperatively in a multidisciplinary context assuming and respecting the role of the different members of the team.

Learning Outcomes

1. Correctly dimension the infrastructure of the database required for the management and mass storage of data in a given service.
2. Design relational or non-relational databases appropriate to the characteristics of the data that they aim to represent, manipulate and store.
3. Enquire into a database to efficiently extract relevant information for analysing the required data.
4. Make effective use of bibliographical resources and electronic resources to obtain information.
5. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
6. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
7. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
8. Using criteria of quality, critically evaluate the work carried out.
9. Work cooperatively in a multidisciplinary context, taking on and respecting the role of the distinct members in the team.

Content

BLOCK 1. PARAMAGES OF DATABASES

1. Introduction. Basic concepts
   - Introduction and definitions
   - Components of a Database system
   - Historical evolution
   - Advantages and disadvantages of a database system
2. Architecture of relational databases
   - ANSI-SPARC Architecture
   - DBA and

DBMS

   - Back-end/front-end architecture

BLOCK 2. RELATIONAL MODEL

3. Relational Model: Data Structure and Integrity Rules
   - Data structure
   - Integrity Rules
4. Relational Model: Data Manipulation
   - Relational algebra
   - Relational calculus

BLOCK 3. DESIGN OF DATABASES

5. Conceptual Design
   - Design of a BD
   - Capture and analysis of requirements
   - E-R diagram
   - Extended E-R model
   - Design of a E-R database schema

6. Logical Database Design
   - Tables (Relational Model)

7. Normalization
   - Theory of Normalization
   - Normal Forms: 1NF, 2NF, 3NF
   - Boyce-Codd Normal Form (BCNF)

BLOCK 4. PHYSICAL LEVEL

8. Physical Design
   - Access to the physical Database.
   - Storage structures
   - Compression techniques

Methodology

The final objective of the course is that students are able to design and manipulate relational databases in the context of current computer applications. For this reason, the classes will be highly practical and will focus on the students consolidating knowledge of the subject.

The general methodology of the subject is divided into two parts.

THEORY AND PROBLEMS SESSIONS. The objective is to present the students with the main concepts and put them into value within the context of the subject. The teaching staff will ensure that the students deepen these concepts through exercises (more or less) guided during the session. That is why the classes will be held in 2 weekly sessions of 2 hours each in classrooms equipped with computers and connection to the server. Attendance at the classroom is NOT COMPULSORY, but is RECOMMENDED.

AUTONOMOUS WORK. Two activities are proposed: 1) self-learning of SQL queries and 2) a case of use in the design of a real database including analysis of requirements, design and typical queries of SQL. The deliveries of the autonomous work will be done via Caronte (http://caronte.uab.cat).

The first activity will consist of a self-study of SQL queries using a self-assessment module available in Caronte. The student will upload the queries to Caronte in a specific format to be evaluated.

In the second activity the student will be presented with a real case of DB design so that the student can carry out all the design phases: acquisition and requirements analysis, E-R design, logical design and test set. This activity will be carried out in groups of 5 people who must register through Caronte. The different stages of the technical report will be followed throughout the course. At the end of the course, the group must submit a technical report that will be evaluated. In addition, two assessable delivery activities will be enabled to Caronte: a first delivery of the E/R design with which to obtain the teacher's feedback and the final delivery.

All the material (statements, DB scripts, results of the problems) will be available in the document manager Caronte (http://caronte.uab.cat).

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory and problems sessions	50	2	1, 2, 3, 4
Type: Supervised			
Monitoring and reinforcement in the resolution of the use case	4	0.16	8, 7
Type: Autonomous			
Disseny de BD	43	1.72	1, 2, 3, 6, 9, 4
Individual study	15	0.6	3, 5, 4
Problem solving individually and in groups	34	1.36	8, 3, 9

Assessment

The evaluation of the topic will take into account three types of evaluation activities: problem delivery (SQL queries), individual evaluation and use case (technical report).

The final mark of the subject is obtained by combining the evaluation of these 3 activities as follows:

Final note = (0.3 *Delivery of problems) + (0.3 * Individual evaluation) + (0.4 * Use case)

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivery of problems	30%	0	0	3
Individual evaluation	30%	4	0.16	3, 7, 4
Use case	40%	0	0	8, 1, 2, 3, 6, 5, 9, 4

Bibliography

Material of the subject: http://caronte.uab.cat

Basic bibliography:

- A. Silberschatz, H.F. Korth, S. Sudarshan, Fundamentos de Bases de Datos, 5a edición, McGraw-Hill, 2006.
- C.J. Date, Introducción a los sistemas de Bases de Datos, Vol.1, 7a edición, Prentice Hall, 2001.

Multi-user relational databases:

- http://www.oracle.com/ , Oracle®
- http://www.mysql.com/, MySQL®
- http://www.postgressql.org, PostgreSQL®
- http://www.sybase.com/home , Sybase®
- http://www.microsoft.com/sql/default.asp, Microsoft SQL Server®
- http://www-4.ibm.com/software/data/db2/, IBM DB2®
- http://www-01.ibm.com/software/data/informix/, IBM Informix®