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270212 - BD - Databases

Coordinating unit: 270 - FIB - Barcelona School of Informatics

Teaching unit: 747 - ESSI - Department of Service and Information System Engineering

Academic year: 2019

Degree: BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan

Prior skills

To know the data structures in internal memory. To be able to implement programs of medium complexity.

Degree competences to which the subject contributes

Basic:

CB2. That the students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defense of arguments and problem solving within their area of ??study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of ??study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

Specific:

CE7. Demonstrate knowledge and ability to apply the necessary tools for the storage, processing and access to data.

Generical:

CG1. To design computer systems that integrate data of provenances and very diverse forms, create with them mathematical models, reason on these models and act accordingly, learning from experience.

CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.

Transversal:

CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

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Teaching methodology

Theory classes / problems
Autonomous learning: To prepare classes the student may have to read and understand materials and / or notes indicated by the teacher. Afterwards in class, the student needs to review and solve exercises on the topic of study.
Theory classes In lectures the teachers present a part of the contents of the subject. Normally, teachers use transparencies that students would be advised to obtain before classes, in order to do a better follow-up.
Problems classes In problem classes, students solve exercises about content presented during theory classes. These exercises are done in teams of two students according to a cooperative learning technique.
Evaluation. In four of the problem classes, students will solve an exercise that will be collected and evaluated by the teacher.

Laboratory classes
Autonomous learning: The contents that are worked on in the laboratory classes will be studied autonomously by the students. Each week before in the laboratory class students will have a homework assignment that will end with the resolution of a moodle / LearnSQL quiz.
Laboratory classes: Class work will be in teams of 2 students. Students have the opportunity to share doubts with their teammate about the work they have done at home, and if necessary, to ask questions that are not resolved to the teacher. Next the students do the activities that the teacher has indicated and finally solve the class questionnaire.
Assessment: There are three weeks in which laboratory tests are carried out, which count as an evaluation act of the subject.

Learning objectives of the subject

1.To have a general vision of what a database is, what is a database model, the types of users of databases and which are the categories of databases languages.
2.To know the objectives of a database management system and their architecture.
3.To understand the database relational model, their languages (SQL and relational algebra) and the usual components of a relational database.
4.To be able to define, create and manipulate usual relational database components.
5.To be able to build programs to manage relational databases.
6.To be able to apply some defined quality criteria to choose between several SQL statements, database components, or programs, that manage a database and implement the same functionality.
7.
To have an overview of data warehouses and multidimensional databases, and to know how to express OLAP statements via SQL.
8.To be able to apply some defined quality criteria to choose between several SQL statements, database components, or programs, that manage a database and implement the same functionality.
9.To have a general vision of how the design of a database should be included in a software development process.
10.To be able to obtain a database relational model starting from a conceptual models in UML.
11.To know the concept of database transaction and its implications.
12.To know how to identify the different types of interference that can occur between database transactions and their relationship with the isolation levels that defines the SQL Standard.
13.To know the locking concurrency control technique.
14.To know the possible physical structures for storing data and its implications for in terms of efficiency.
15.To know the access methods to data and its implications in terms of efficiency.

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Study load

Total learning time: 150h	Theory classes:	30h	20.00%
	Laboratory classes:	30h	20.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

Introduction

Degree competences to which the content contributes:

Description:
Database concept. Database design and models. Types of users. Categories of languages. Concept of database management system (DBMS). Desirable goals for databases that DBMSs must provide. Architecture of the DBMS.

The relational model

Degree competences to which the content contributes:

Description:
Objectives and origin. Structure of data with which the relational databases are built. Operations provided by the relational model to manipulate and query the data. Integrity rules to be met by the data in a relational database.

Languages: Relational algebra and SQL

Degree competences to which the content contributes:

Description:
Introduction. Relational algebra: operations of relational algebra; queries. SQL: table creation; insertion, deletion and modification of rows in a table; queries on a database. Considerations about the implementation of queries.

Logical database components

Degree competences to which the content contributes:

Description:
Concept of a logical database component: data and control components. Introduction to the data components: schemes, tables and domains, assertions and views. Introduction to the control components: stored procedures, triggers and privileges.

Data Warehouses and OLAP

Degree competences to which the content contributes:

Description:
Introduction to data warehouses and multidimensional databases. SQL Extensions for OLAP

SQL Programming

Degree competences to which the content contributes:

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Description:
Programming in Java and JDBC. Considerations and quality criteria in the design and implementation of programs that access databases.

Introduction to the design of relational databases

Degree competences to which the content contributes:

Description:
Stages in the design of a database. Introduction to the understanding of simple UML conceptual models. Translation of simple UML conceptual models to relational model databases

Transactions and concurrency

Degree competences to which the content contributes:

Description:
Concept of transaction. ACID properties of transactions. Interference between transactions. Serializability. Recoverability. Concurrency control techniques. Isolation Levels. Locking and isolation levels.

Physical storage structures, access methods and optimization

Degree competences to which the content contributes:

Description:
Introduction. Access methods to perform queries and updates in a database. Costs of the different access methods. Introduction to Ouery Optimaztion

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Planning of activities

Study of the database introduction	Hours: 8h Theory classes: 2h Practical classes: 0h Laboratory classes: 2h Guided activities: 0h Self study: 4h
Specific objectives: 1, 2	

Study of the databases introduction	Hours: 2h Theory classes: 0h Practical classes: 0h Laboratory classes: 0h Guided activities: 0h Self study: 2h
Specific objectives: 3	

Study of the data logical components	Hours: 12h Theory classes: 2h Practical classes: 4h Laboratory classes: 0h Guided activities: 0h Self study: 6h
Specific objectives: 3, 4, 6	

Study of the introduction to design of relational databases	Hours: 8h Theory classes: 2h Practical classes: 2h Laboratory classes: 0h Guided activities: 0h Self study: 4h
Specific objectives: 9, 10	

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Study of transactions and concurrency	Hours: 12h Theory classes: 2h Practical classes: 4h Laboratory classes: 0h Guided activities: 0h Self study: 6h
Specific objectives: 11, 12, 13	

Study of storage, access methods and optimization	Hours: 17h Theory classes: 6h Practical classes: 4h Laboratory classes: 0h Guided activities: 0h Self study: 7h
Specific objectives: 14, 15	

Study of the Relational Algebra and SQL	Hours: 22h Theory classes: 0h Practical classes: 0h Laboratory classes: 10h Guided activities: 0h Self study: 12h
Specific objectives: 3, 4, 6	

Study of data warehouses and in OLAP	Hours: 8h Theory classes: 2h Practical classes: 0h Laboratory classes: 2h Guided activities: 0h Self study: 4h
Specific objectives: 6, 7, 8	

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Study of stored procedures and triggers	Hours: 12h Theory classes: 0h Practical classes: 0h Laboratory classes: 6h Guided activities: 0h Self study: 6h
Specific objectives: 3, 4, 6	

Programming with SQL - JDBC	Hours: 8h Theory classes: 0h Practical classes: 0h Laboratory classes: 4h Guided activities: 0h Self study: 4h
Specific objectives: 4, 5, 6	

Laboratory control: Relational Algebra Languages, SQL, OLAP via SQL	Hours: 4h Guided activities: 2h Self study: 2h
Specific objectives: 4, 6, 7	

Laboratory control: stored procedures and triggers	Hours: 4h Guided activities: 2h Self study: 2h
Specific objectives: 4, 6, 8	

Laboratory control: Programming with SQL - JDBC	Hours: 4h Guided activities: 2h Self study: 2h
Specific objectives: 5, 6, 8	

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Final Exam	Hours: 26h Guided activities: 3h Self study: 23h
Specific objectives: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	

Reviews and resolution of doubts about the exams	Hours: 3h Theory classes: 0h Practical classes: 0h Laboratory classes: 0h Guided activities: 3h Self study: 0h

Qualification system

The grade of the course is based on technical competencies:

- NEF: Final exam grade.

- NPR: Problems grade. It is the average of the grades of the four problems exam.

- NLB: Laboratory grade. It is calculated as the 40% of the grade of the part algebra / SQL, 30% of the grade of the part of procedures / triggers and 30% of the grade of the part of programming with SQL - JDBC.

Final grade = Maximum (

NLB * 0.25 + NEF * 0.60 + NPR * 0.15,
NLB * 0.25 + NEF * 0.75
)

- For students who can concur to the reevaluation, the reevaluation examen grade will replace NEF

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Bibliography

Basic:

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Gulutzan, P.; Pelzer, T. SQL-99 complete, really. R & D books, 1999. ISBN 0879305681.

Liu, L.; Özsu, M.T. Encyclopedia of database systems [on line]. Springer, 2009Available on: <https://link.springer.com/referencework/10.1007/978-0-387-39940-9>. ISBN 9780387399409.

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