Universitat Autònoma de Barcelona

2019/2020

Database Analysis and Design

Code: 102186
ECTS Credits: 6

Degree	Type	Year	Semester
2501232 Business and Information Technology	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: No

Other comments on languages

Although lessons will be imparted in Spanish, students will be able to make questions in Catalan or English

Prerequisites

There are no previous requirements for this subject

Objectives and Contextualisation

In this course we will introduce basic concepts of relational databases (DB), which are necessary both for users and designers.

Knowledge:

At the end of the course the student will be capable of:

- Knowing and understanding the important technological jump represented by database systems regarding the treatment of information as well as the design and maintenance of data manipulation applications.
- Knowing and understanding the architecture of database systems, the functions of each module and those of the personnel involved in its creation and day-to-day running (users, programmers, administrators, etc.)
- Comprehending the design methodology of a database
- Understanding the entity-relationship model (E-R model)
- Knowing and understanding the properties of the relational model, as implemented in most database engines.
- Knowing and understanding the SQL language, the relational database standard language

Abilities:

At the end of the course the student will develop the following abilities:

- Ability to design the E-R model of a database from a series of real-world specifications
- Ability to convert the E-R model into the set of attributes and relationships that compose a real relational database

- Ability to use the integrity rules of the relational model to be able to fill the database with data and guarantee its consistency and general robustness.
- Ability to make simple and relatively complex queries to the database using SQL language.
- Ability to work with a typical DB engine such as Oracle (whose use is very extended in the professional world)

Competences

- Appropriately drawing up technical reports according to the customer's demands.
- Demonstrating a concern for quality in the objectives and development of the work.
- Designing and configuring models and systems that are able to gather, store, transmit, process and recover digital information in a reliable and efficient manner.
- Students must be capable of analysing, summarising, organising, planning and solving problems and making decisions.
- Working in teams, sharing knowledge and communicating it to the rest of the team and the organisation.

Learning Outcomes

1. Appropriately drawing up technical reports according to the customer's demands.
2. Demonstrating a concern for quality in the objectives and development of the work.
3. Designing and configuring models and systems that are able to gather, store, transmit, process and recover digital information in a reliable and efficient manner.
4. Students must be capable of analysing, summarising, organising, planning and solving problems and making decisions.
5. Working in teams, sharing knowledge and communicating it to the rest of the team and the organisation.

Content

. Introduction and basic concepts

- Introduction and definitions
- Components of a database system.
- Historical evolution.
- Advantages and disadvantages of a database system.

2. Architecture

- ANSI-SPARC architecture
- DBA and SGBD
- Back-end/front-end architecture

3. Design. The entity-relationship model

- Design of a database
- Entity-relationship model
- Extended entity-relationship model
- The design criteria of an E-R schema
- E-R schematic design

4. The relational model of databases

- Introduction
- Database structure
- Integrity rules
- Database manipulation: relational algebra and SQL queries

5. The design of a database

- Design stages of a database
- Requirements' capture and analysis
- Conceptual design of a database
- Logical design
- Physical design
- Normalization

6. Internal level

- Physical database access
- Storage structures: Indexing, Hashing (dispersion)
- Compression techniques

Methodology

The learning process will be based in three kinds of activities: (a) theory lessons and problems, (b) practical sessions, and (c) the creation of a database with its corresponding technical report. All the documentation and the necessary materials for following the course will be available from the course online platform (http://caronte.uab.es)

FORMATIVE ACTIVITIES LED BY THE TEACHER

Theory and Problems:
Theory classes will be imparted on the screen using electronic support and whiteboard. We will introduce all the necessary theoretical concepts to be able to solve the problems that will appear along the course. During the problem time we will solve some exercises in class and encourage students to do the rest autonomously, using the database and exemplary solutions. Problem lessons will be divided in two blocks: (a) relational database design and (b) database query.

(a) In the first problem group, we will practice the E-R design following some specific practical requirements.

(b) In the second problem group we will explain the basic concepts of Relational Algebra (RA) and Structured Query Language (SQL) over an exemplary database. We will query this database in both RA and SQL with increasing levels of complexity. The idea is to use the concepts of RA to understand the logic behind SQL querying with emphasizing that RA could be of much use in complex queries. We will provide the results of the queries for the students to verify their results.

Lab practice:
In lab practical sessions, we will introduce the student to the practical side of Structured Query Language (SQL) language, which is the standard language to query relational databases.

The course will include 5 practical sessions in a closed regime, i.e. each session will consist of a series of exercises on a database with the objective of comprehending the concepts explained in previous theory lessons. The general idea is also to familiarize the student withthe practical side ofdesigning, creating and manipulatingrelational databases as users and programmers. Practical work will be assessed and evaluated after every practical session.

The assistance to practical sessions IS COMPULSORY. Students should prepare the work explained in the practical coursework. This preparation must occur before the corresponding practical session. The work ends by assisting to the practical sessions tutorised by the teach at the time agreed.

Practical coursework material, timetables for presentations and evaluations will be publicised in Caronte (http://caronte.uab.es). We will make all possible efforts to allow the students to complete the practical work at home, although in some cases this might not be possible, and these should be completed using university computers.

AUTONOMOUS FORMATIVE ACTIVITIES

Creation of a database with its corresponding technical report:
Alongside theory lessons, problems and practical lessons, all students should participate in the creation of a database. This process will be complete by submitting a technical report, the scripts necessary for the task, and a test set for database validation. This will be accomplished in groups of 4 or 5 students whose work will be mostly autonomous under the supervision of the teacher in tutorial time.

Self-assessed SQL practical work:
Alongside theory lessons, problems and practical sessions, all students should participate in self-assessed partical work consisting in the resolution of SQL problems online. This work will be done individually by students at the time they consider most convinient within the dynamic of the course. The statements of these SQL problems, alongside the instructions on how to complete them and evaluate them will be available through the document platfom Caronte well in advance.

SUPERVISED FORMATIVE ACTIVITIES

Tutorials:
These can be group-based or one-to-one based depending on the subject to discuss. The objective of these tutorials is to solve doubts and consolidate the knowledge acquired during the week. The tutorial timetable will be availabla at the begining of the course, but the student should tell the teacher (preferently by e-mail) his/her intentions to assist to a tutorial well in advance.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical work	10	0.4	2, 3, 1, 4, 5
Problems	10	0.4	2, 3, 5
Theory lessons	26	1.04	3
Type: Supervised			
Tutorials	15	0.6	3, 4
Type: Autonomous			
Creation of a database and its corresponding report	25	1	
Exercise preparation and problem resolution	15	0.6	
Practical session preparation	5	0.2	5
Study	36	1.44	

Assessment

The assessment of the coursework consists of 5 parts: theory examination, assessment of E-R design problems, the drafting of a technical report, practical work evaluation, and the resolution of SQL queries. The weight of each of these asessments can be seen in the evaluation activities table. The final mark will be the weighted average of the marks of each part whenever the minimum mark of each evaluation is exceeded. The minimum mark for the evaluation of the theory exam is of 4. For the other evaluations there is no minimum mark. A note of 5 or more must be obtained to pass the course. A student is considered "Not Evaluated" only if he/she has not done any evaluation activity at all.

Students who are in one of the following two situations can be re-evaluated:
(a) Students who pass the minimum mark for the theory exam (a 4) and obtain a total grade of the course between 3.5 and 5. (Theory > 4 but with 3.5 <= Final Note < 5)
(b) Students who have a final grade sufficient to pass the course but have a low grade (less than 4) in the final theory exam. (Theory Note < 4 but with Note_Final > = 5)

In this re-evaluation test, which will be written and will take place during the last week of the semester, the student will be re-evaluated in the same contents as in the theory exam. In this re-evaluation, the only possible notes are "approved" or "suspended". If approved, the final grade of the course will be "pass" (the minimum grade of 5).

Students in the following situation will pass the course with a final grade equal to the minimum grade (a 5):
(c) Students who obtain a total grade of the course between 3.5 and 5, but have passed the theory exam (3.5 <= Note_Final < 5 but with Theory Note > = 5)

In the case of not reaching the minimum required in the theory exam, the minimum score between the final mark (obtained from the weighted average) and a 4.5 will be placed in the file. (The subject is considered approved if the final grade exceeds 5).

EVALUATION CRITERIA

- THEORY AND PROBLEMS' EXAMS. There will be two individual written exams, with a weight of 20% and 30% on the final grade. The first will be done in the middle of the semester and will evaluate the basic concepts and skills acquired for the design of a database (E-R model). The second will be done at the end of the semester and will evaluate the theoretical concepts of the whole course and the skills in the resolution of SQL queries.
- PRACTICE EXERCISES EXAM. The evaluation of the practical work is carried out by means of set of SQL queries realized in the last session of practices and where the student will have access to his notes. The format will be the same as that of the autonomous learning module.
- SQL SELF ASSESMENT AND TECHNICAL REPORT: It will be divided into two blocks: technical report (20%) and resolution of autonomous queries in SQL (10%). The Technical Report consists of 4 parts corresponding to the 4 design phases of a BD: Requirements, ER diagram, Logical Logic Model and Implementation/Test part. The document must have the appropriate format so that the diagrams of the E-R design and the logical model of tables can be read correctly. If a diagram can not be read clearly for reasons of resolution or quality, this part of the report will be suspended, as well as those that depend on it, since they can not be evaluated. You will be given an assessment of the technical report in the middle of the semester and a second assessment (with the final mark) upon completion of the report. The final mark of the technical report will be calculated from the two notes (mark1 and mark2) as follows:

Mark_TR = max [(mark1 + mark2) / 2; 0.7 * mark2]

The resolution of autonomous queries in SQL will be done outside class schedules through an online self-learning module. This autonomous learning module will beavailableduring the next two weeks of each practice. Thenote will be proportional to the number of questions answered throughout the course and its difficulty.

OTHER IMPORTANT INFORMATION

• REGISTRATION IN CARONTE: Students should register in Caronte (http://caronte.uab.cat) at the beginning of the course, since coursework materials, practical assignments and final marks are published there. To register in Caronte it is necessary to enter personal data and a photo card in JPG format. This information will remain strictly private and will be destroyed once the course has finished.
• CONVALIDATIONS: There will be no special treatment for students who repeat the course.
• HONOR REGISTRATIONS: Students who have more than 9.5 in the final mark will have an honor matriculation (MH) up to the limit of 5% of those enrolled, according to UAB regulations. In the case of having more than 5% of the students over 9.5, MH will be awarded to those who have the highest marks.

PLAGIARISM: Without prejudice to other disciplinary measures that may be considered appropriate, the irregularities committed by any student that can lead to a variation in the markings of an evaluation act will lead to a grade of zero. Therefore, copying, plagiarizing, cheating, copying, etc. in any of the assessment activities it will imply a suspension and result in a zero mark. Assessment activities qualified in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the subject, this subject will be suspended directly, without opportunity to recover it in the same course. In the case of the Technical Report, all the groups involved will be punished with zero (0), regardless of the authorship of the work.

Calendar of evaluation activities

The dates of the evaluation activities (midterm exams, exercises in the classroom, assignments, ...) will be announced well in advance during the semester.

The date of the final exam is scheduled in the assessment calendar of the Faculty.

"The dates of evaluation activities cannot be modified, unless there is an exceptional and duly justified reason why an evaluation activity cannot be carried out. In this case, the degree coordinator will contact both the teaching staff and the affected student, and a new date will be scheduled within the same academic period to make up for the missed evaluation activity." ***Section 1 of Article 115. Calendar of evaluation activities (Academic Regulations UAB)****.* Students of the Faculty of Economics and Business, who in accordance with the previous paragraph need to change an evaluation activity date must process the request by filling out an Application for exams' reschedule
https://eformularis.uab.cat/group/deganat_feie/application-for-exams-reschedule

Grade revision process

After all grading activities have ended, students will be informed of the date and way in which the course grades will be published. Students will be also be informed of the procedure, place, date and time of grade revision following University regulations.

Retake Process

"To be eligible to participatein the retake process, it is required for students to have been previously been evaluated for at least two thirds of the total evaluation activities of the subject." Section 3 of Article 112 ter. The recovery (UAB Academic Regulations). Additionally, it is required that the student to have achieved an average grade of the subject between 3.5 and 4.9.

The date of the retake exam will be posted in the calendar of evaluation activities of the Faculty. Students who take this exam and pass, will get a grade of 5 for the subject. If the student does not pass the retake, the grade will remain unchanged, and hence, student will fail the course.

Irregularities in evaluation activities

In spite of other disciplinary measures deemed appropriate, and in accordance with current academic regulations, *"in the case that the student makes any irregularity that could lead to a significant variation in the grade of an evaluation activity, it will be graded with a 0, regardless of the disciplinary process that can be instructed. In case of various irregularities occur in the evaluation of the same subject, the final grade of this subject will be 0".* ***Section 10 of Article 116. Results of the evaluation. (UAB Academic Regulations).***

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
E-R problems evaluation	20%	1.5	0.06	3, 4
Practical work	20%	2	0.08	2, 4, 5

SQL queries test	10%	2	0.08	2, 3, 4
Technical report	20%	0.5	0.02	2, 1, 4
Theory exam	30%	2	0.08	3, 4

Bibliography

Basic Bibliography

- A. Silberschatz, H.F. Korth, S. Sudarshan, Fundamentos de Bases de Datos, 5a edición, McGraw-Hill, 2006.
- A. Silberschatz, H.F. Korth & S. Sudarshan, Database system concepts (7th ed., International ed. ed.). New York, N.Y.: McGraw-Hill, 2018.
- C.J. Date, Introducción a los sistemas de Bases de Datos, Vol.1, 7a edición, Prentice Hall, 2001.
- C.J. Date, An introduction to database systems (8th ed.). Boston, Mass.; London: Pearson/Addison-Wesley, 2004.

Complementary bibliography

- A. Fowler, NOSQL for Dummies, For Dummies; 1 edition, 2015
- Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013
- C.A. Coronel & S.A. Morris, Database systems : design, implementation, and management (13 ed.): Course Technology, 2018
- T.M. Connolly & C.E. Begg, Database systems : a practical approach to design, implementation, and management (6th ed. ed.). Boston, MA: Pearson Education, 2014.
- P. Rob, C. Coronel, Sistemas de Bases de datos. Diseño, implementación y administración, Thomson-Paraninfo, 2004.
- M. Celma, J.C. Casamayor, L. Mota, Bases de Datos Relacionales, Pearson-Prentice Hall, 2003.
- D.M. Kroenke, Procesamiento de Bases de Datos, 8ª edición, Pearson-Prentice Hall, 2003.
- A. de Miguel, M. Piattini, Diseño y uso de Bases de Datos Relacionales, Ra-Ma, 1997.
- G.W. Hansen, J.V. Hansen, Diseño y administración de Bases de Datos, 2a edición, Prentice Hall, 1997.
- C.J. Date, H. Darwen, A Guide to the SQL standart, 3rd edition, Addison-Wesley, 1994.

Web links

- Complete online documentation of the latest version of Oracle's most popular products. (http://docs.oracle.com/en/database/)
- Oracle 12c Quick Reference Manual (E41527-27 March 2017) Release 1 (12.1). (https://docs.oracle.com/database/121/REFRN/title.htm)
- Guide to the universe of non-relational databases (http://nosql-database.org/)
- C. Strauch, NoSQL Databases (http://www.christof-strauch.de/nosqldbs.pdf)