

Database Management and Administration

Code: 102741
ECTS Credits: 6

Degree	Type	Year	Semester
2502441 Computer Engineering	OB	3	1
2502441 Computer Engineering	OT	4	1

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

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

- Characteristics, functionality and structure of Database systems.
- Relational model of Databases and SQL language at query level.
- To design a Database with the E / R model and build the associated relational model.

These concepts correspond to contents of the subject of Databases

Objectives and Contextualisation

In this subject we introduce the advanced concepts of Database (BD) necessary both at the designer level of BD and user.

KNOWLEDGE: At the end of the course the student must be able to:

- To know, to understand and to know how to use the main BD management tools to be able to parameterize the BD in the most optimum way according to the needs of users and processes.
- To know, to understand and to know how to use the main BD optimization tools.
- To understand and to know how to configure distributed BDs.
- To understand and to know how to use non-relational BD.

SKILLS: It is intended that students acquire the following abilities:

- To set up a BD system in the most optimal way based on some needs.
- To optimize the execution of transactions that maximizes the response time and the use of resources available to the BD.
- To use the SQL language immersed to design, program and verify BD applications based on programming languages and SQL.
- To use and configure a non-relational BD based on a BD design I / O.

To work with the previous skills with relational DBMS, such as ORACLE, which is widely used in the professional field, both at user level and administrator level and non-relational DBMS, such as mongoDB.

Competences

Computer Engineering

- Ability to develop, maintain and evaluate software services and systems that meet all user requirements and behave reliably and efficiently, are affordable to develop and maintain and meet quality standards, applying theories, principles, methods and practices of the Software engineering.
- Acquire thinking habits.
- Have the capacity to conceive, develop and maintain computer systems, services and applications employing the methods of software engineering as an instrument to ensure quality.

Learning Outcomes

1. Apply different management tasks of DB in practic cases.
2. Apply query scheduling for resource optimization.
3. Develop a capacity for analysis, synthesis and prospection.
4. Develop and maintain data models that serve as a basis for software systems.
5. Know the limitations of different error recovery systems and understand the process involved in Rollback.
6. Know the mechanisms of consultation and synchronization of nodes in distributed systems.
7. Know the methods for optimising databases and the mechanisms of administration and parametrisation of the same.
8. Know the bases of the paradigm of DDBB oriented to objects.

Content

1. Object oriented and non-relational BD (10 hours)

- Basic object-orientation concepts.
- Identity and structure of an object.
- Encapsulation of operations, methods and persistence.
- Basic concepts of non-relational databases: MongoDB.

2. Physical design (10 hours)

- Internal representation of data.
- Oracle: tablespaces and datafiles.
- MongoDB: WiredTiger.

3. Access and security control (10 hours)

- Discretionary access control (DAC).
- Mandatory access control (MAC).
- Access control through roles (RBAC).

4. Processing and processing of transactions (10 hours)

- Concepts and registration of the system.
- ACID properties.
- Classification of transactions based on recoverability.

5. Recovery of BD (20 hours)

- Recovery concepts.
- Recovery techniques based on delayed and immediate update.
- Shadow paging.
- ARIES Algorithm.
- Database backup and recovery against catastrophic failures.

6. Concurrency Control (30 hours)

- Transaction planning.
- Classification of transactions based on serialization.
- Administration of SQL transactions.
- Deadlock and starvation
- Locking techniques: Granularity
- Techniques based on temporary brands
- Multiverse techniques

7. Physical design and refinement of BD (10 hours)

- Data storage.
- Indexing.
- Hashing.

8. Queries processing (20 hours)

- Architecture.
- Translation of SQL queries
- Implementation of relational operators
- Process in sequence
- Heuristics of optimization

9. Distributed BD (30 hours)

- Basics
- Techniques of fragmentation, replication and allocation of data
- Types of distributed BD systems
- Concurrence control
- DDB in Oracle i MongoDB

* The hours in parentheses are estimates of the hours that the students will dedicate to each subject, counting the classroom hours in class and the hours outside the classroom.

Methodology

In this subject we will follow a reverse class methodology. In this methodology, the study of the theoretical contents must be carried out before the face-to-face sessions, and as autonomous activities of the students, based on material and documentation that students will have access through the virtual campus of the subject . In-class classes become practice sessions for solving exercises and carrying out the project, aimed at solving all the doubts and problems that have been encountered throughout the week.

There will be two types of activities: theory and project activities. The theory activities will be aimed at consolidating the most theoretical aspects of the subject. A part of them will be individual while others will be done in work groups. The project will be an essentially practical group activity that will be carried out throughout the course and will help to consolidate the theoretical aspects worked in class.

The work groups will be groups of 4 students, will be formed on the first day of class and will remain stable throughout the course. They will be the same for group theory activities and the project.

Not counting the hours that have to be devoted to prepare the partial exams. An average load of 9 hours per week and student distributed in the following activities has been calculated:

- Previous work: an average of 2 hours per week is estimated that will have to be devoted to reading or visualizing the material that will be used in face-to-face sessions.
- Completion of the project: it is estimated an average of 3 hours per week and a member of the group that will have to dedicate to do the project in addition to the hours that are dedicated on time to the sessions dedicated to the resolution of problems and project.

- Problem solving and project: the weeks with the least workload devoted to the project will be devoted to making more resolutions of exercises and problems of the topics worked in the face-to-face sessions.

Cross-disciplinary competences: In this subject the competence T01.02 must be worked out - Develop the capacity for analysis, synthesis and prospecting. This will be done throughout the course in all the activities that must be done but with more intensity in the resolution of problems and project.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Inclass sessions	26	1.04	7, 3
Type: Supervised			
Problem solving and project	24	0.96	2, 1, 7, 3
Type: Autonomous			
Previous work	26	1.04	2, 1, 6, 7, 8, 5, 4, 3
Study and preparation of partial tests	20	0.8	6, 7, 8, 5, 3
project development	39	1.56	2, 1, 7, 4, 3

Assessment

The evaluation will be carried out continuously. There will be two individual theoretical-practical tests in writing, with a weight of 50% each on the final grade. The first test (Par1) will be done approximately in the middle of the semester and will evaluate the theoretical concepts and management skills and administration of databases treated in the 1st part of the course. The second test (Par2) will be done at the end of the semester and will evaluate the theoretical concepts and management skills and database administration discussed in Part 2 of the course.

Recovery exam: In the event that the Theory Note does not reach the approved, students may submit to a review of recovery on all the contents covered in the theory class.

Most of the weeks there will be the possibility to deliver activities worked during the week. The delivery is optional and can be done up to hours set in advance to the Virtual Campus. With 50% of the maximum possible score you will be able to achieve the maximum score (1 point) of this activity (NPrb). The note will be obtained from cross-correction activities between students who are qualified for each delivery.

Cross-correction problems (CorPr) are optional and may be made by students who have handed over the problems exercises. Students will be able to obtain a maximum of one point in this activity that will be added to the theory mark whenever the minimum mark has been obtained in all the partial ones.

The note of the project will leave from the average of the notes obtained in each delivery. There will be 3 deliveries: Prj1, Prj2 and Prj3. The note of each delivery will proceed to make the arithmetic mean of a group note and one individual. Each one of the deliveries will have to be approved. In the case of suspending some delivery, the option of recovering the suspended part will be given. The note of recovery will be a maximum of 5.

QUALIFICATION INDICATORS:

The final grade of the subject is calculated as follows:

- Partial Note 1 = Par1
- Partial Note 2 = Par2
- Note Theory = $0'5 * \text{Par1} + 0'5 * \text{Par2} + \text{NPrb} + \text{CorPr}$
- Project Note = $1/3 * \text{Prj1} + 1/3 * \text{Prj2} + 1/3 * \text{Prj3}$
- FINAL NOTE SUBJECT = $0'5 * \text{Note Theory} + 0'5 * \text{Project Note}$

EVALUATION CRITERIA

- In order to count the notes of problems (NPrb) you need to obtain a minimum of 4 in the middle of the partial: $= 0'5 * \text{Par1} + 0'5 * \text{Par2} >= 4$.
- In order to count the note of the deliveries of the project (Prj) you must obtain a note greater than or equal to 5 in all the deliveries.
- In the case of suspending some of the deliveries of the project the maximum grade that can be obtained in the recovery is 5.
- In order to consider approved either of the two parts (theory and practices) a minimum of 5 must be obtained.
- The subject will be approved if the SUBJECT FINAL NOTE is greater than or equal to 5.
- In case of not reaching the minimum required in any of the assessment activities, the numerical note of the file will be the lowest value between 4,5 and the weighted average of the notes,
- NOT ASSESSABLE: If you do not present an evaluation activity.
- REPEATERS: No approved part is approved (theory, project) from one academic year to another.
- IMPORTANT FOR ALL STUDENTS: It is important to enroll in the virtual campus of the subject at Caronte (<http://caronte.uab.cat>), because the materials of the subject are published, the activities are carried out and the final notes of the subject are published.
- Granting an honorific matriculation qualification is a decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be awarded to students who have obtained a final grade of 9.00 or more. It can be granted up to 5% of MH of the total number of students enrolled.

EVALUATION CALENDAR:

- Partial Exams: schedule announced at the beginning of the semester.
- Recovery Exam: according to the academic calendar of the School of Engineering.
- Deliveries of the activities: date and time fixed in advance to the Caronte.
- Deliveries of the project: date and time fixed in advance to the Caronte.

The delivery dates to Caronte (<http://caronte.uab.cat>) and may be subject to changes of programming due to adaptation to possible incidents. Charon will always be informed about these changes since it is understood to be the usual mechanism for exchanging information between teacher and students.

For each assessment activity, a place, date and time of revision will be indicated in which the student will be able to review the activity with the teacher. In this context, claims can be made about the activity note, which will be evaluated by the teachers responsible for the subject. If the student does not submit to this review, this activity will not be reviewed later.

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the current academic regulations, irregularities committed by a student that may lead to a variation of the qualification will be classified by zero (0). 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. These irregularities include, among others:

- the total or partial copy of a practice, report, or any other evaluation activity;
- let copy;
- present a group work not done entirely by the members of the group;
- present as appropriate materials prepared by a third party, even if they are translations or adaptations, and generally works with non-original and exclusive elements of the student;
- Have communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams).

The numerical note of the file will be the lowest value between 3.5 and the weighted average of the notes in case the student has committed irregularities in an evaluation act (and therefore not approved for compensation). In summary: copying, copying or plagiarizing in any of the assessment activities is equivalent to a suspense with a score of less than 3.5.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1st Theory exam	0.25	2	0.08	6, 7, 8, 5, 3
2nd Theory exam	0.25	2	0.08	2, 1, 7, 8, 3
Problem delivery (NPrb)	0.1	2	0.08	2, 1, 6, 7, 8, 5, 4, 3
Project delivery	0.4	6	0.24	2, 1, 7, 4, 3
peer correction exercises (CorPr)	0.05	3	0.12	2, 1, 8, 3

Bibliography

COURS MATERIAL: <http://caronte.uab.cat>.

BASIC BIBLIOGRAFY:

- Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts Sixth Edition, McGraw-Hill.
- Elmasri/Navathe, Fundamentos de Sistemas de Bases de Datos, Addison-Wesley, 5a edición, 2007.
- Ramakrishnan, Gehrke, Sistemas de Gestión de bases de Datos, 3a edición, McGraw-Hill, 2006.

COMPLEMENTARY BIBLIOGRAFY:

- A. Silberschatz, H.F. Korth, S. Sudarshan, Fundamentos de Bases de Datos, 5a edición, McGraw-Hill, 2006.
- T.M. Connolly, C.E. Begg, Sistemas de Bases de Datos, 4a edición, Pearson-Addison-Wesley, 2005.
- P. Rob, C. Coronel, Sistemas de Bases de datos. Diseño, implementación y administración, Thomson-Paraninfo, 2004.
- J. Hernández, M. José Ramírez, C. Ferri, Introducción a la Minería de Datos, Pearson-prentice Hall, 2005.
- 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.
- M. Marqués, J.I. Aliaga, S. García, G. Quintana, SQL y desarrollo de aplicaciones en ORACLE 8, Col.lecció; "Treball d'Informàtica i Tecnologia, 9, Universitat Jaume I, 2001.
- 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.
- C.J. Date, Introducción a los sistemas de Bases de Datos, Vol.1, 7a edición, Prentice Hall, 2001.

WEB LINKS:

- <http://www.acm.org/sigmod> Special Interest Group in Management of Data. Grup de l'ACM (Association of Computer Machinery) which conducts activities on Database, organizes congress and publishes magazines on the subject.
- http://www.jcc.com/SQLPages/jccs_sql.htm, web with SQL language information.
- <https://oai.oracle.com/>, Oracle Academic Initiative (OAI) website with a lot of information of interest relative to the facilities provided by the OAI to the students of the UAB.
- <http://ilearning.oracle.com/ilearn/en/learner/jsp/login.jsp>, Web with Oracle courses.

RELATIONAL & NO RELATIONAL DATABASES:

- <http://www.oracle.com/> , Oracle®
- <https://docs.mongodb.com> , MongoDB
- <http://www.mysql.com/>, MySQL®
- <http://www.postgresql.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®