Universitat Autònoma de Barcelona

2021/2022

Software Architecture and Technologies

Code: 102790
ECTS Credits: 6

Degree	Type	Year	Semester
2502441 Computer Engineering	OB	3	2
2502441 Computer Engineering	OT	4	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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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

Teachers

Helena Bolta Torrell

Prerequisites

There are no official prerequisites, but it is advisable that the student has completed the subject "Enginyeria del Software" from second year and "Gestió i administració de base de Dades" from third year.
While the vehicular language is Catalan, part of complementary notes and documentation are in English, so it is needed a minimum knowledge of this language.
One of the topics to be addressed in this subject (NO-SQL Database) is complemented in the subject Gestió i Administració de Bases de Dades

Objectives and Contextualisation

This subject is divided into separate parts. Each part with an specific, actually and advanced topic of concepts about engineering software.
The aim is to introduce the students to these topics for three or four weeks, giving them a basic knowledge in order to then be able to depeen by themselfs. The selected topics revolve around databases, programming, software architectures, modeling and software development. Each year three or four topics are selected.

Competences

Computer Engineering

- Acquire personal work habits.
- Capacity to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of computer systems, services and applications, as well as of the information that they manage.
- Have the capacity to identify, evaluate and manage potential risks.
- Have the right personal attitude.

Learning Outcomes

1. Design an architecture that can best solve a specific problem, taking into account the associated risks.
2. Design the architecture of a component based computer system.
3. Generate proposals that are innovative and competitive.
4. Make ones own decisions.
5. Manage information by critically incorporating the innovations of ones professional field, and analysing future trends.

Content

The subject consists of 3 different topics but related to the new and modern software engineering environments.
The contents are ambitious, however, as the dynamics of the course aims to be very interactive, the contents could be tailored (lengthen or shorten), depending on the course of the sessions. On the other hand, the proposed topics are in themselves very broad and dense, which makes it impossible to delve into the course of a subject. Nor is it the goal; you want to give an initial outline and basic knowledge.
On the other hand, although all the concepts covered will be duly referenced in the materials delivered or with external reference for consultation, many of them will be developed during the classes, therefore, their assistance is highly recommended, if not indispensable, to acquire all the proposed knowledge.

Topic 1. Introduction to Big-Data

The concept of BigData is the name given to sets of data, procedures and applications which, by its volume, its diverse nature and the speed at which they are to be processed exceed capacity on common computer systems. This data processing is used to detect patterns within them, may well make valid predictions for decision making. This new world of data processing needs new paradigms and strategies of software. The topic will be studied from 2 different angles: from the position of Data Engineer and from that of Data Scientist

Contents:

- Basic concepts.
- Structures and plataforms
  - Hadoop, Spark
- BigData's software engineering
  - Algorithms and patters
  - Models and Data structures
  - Security, robustness and Integrity
- Introduction to IoT in the BigData
- Data mining / Machine Learning / Deep Learning / Predictive analytics
  - Data Scientists

Topic 2. Introduction to the Non Relational Data Bases(NoSQL) and its implementation in MongoDB.

The databases non relational (NoSQL) are the new perspective in the databases. With the exponential growth of the Internet, the volume of data stored has also grown exponentially. These data should be saved, and in certain cases, the relational databases are not the optimal response time. NoSQL databases fits to these cases.
MongoDB is one of these NoSQL databases, which is ideal for storing large volumes of data, metadata documents and unstructured information.
Contents:

- Introduction to the No-SQL databses: defintion, characteristics and types
- MongoDB:
  - Basic concepts
  - Characteristics
  - Introduction to JSON inside MongoDB
  - Operations: insert, import, export, find, updates, deletes, aggregations

        - Implementation in java
    - NoSQL alternatives:
        - Cassandra
        - BigTable
        - AllegroGraph

Topic 3. Introduction to DevOps

DevOps (development and operations) is a culture, movement or practice that emphasizes the collaboration and communication of both software developers and other Information-Technology (IT) professionals. DevOps is a response to the interdependence of software development and IT operations. Its goal is to help an organization produce software products and services quickly.

Contents:

- Introduction to DevOps
    - Basic concepts
    - Characteristics
    - DevOps inside the Agile metodologies
- Structures and platforms
- Cloud computing
- Infrastructures management
- Acceptance tests
- docker, vagrant technologies.

Methodology

Classes of theory and problems in conference format. The teacher introduces the theoretical contents and gives materials (books, articles, web pages) that the student must to read, as well as references so that he can then continue his or her learning. To facilitate the exposition of the subjects, the classes of problems and theory are managed in a uniform way.

Practical sessions. At the beginning of the course students will do small groups (2 or 3 members per group, if possible by the capacity of the laboratories). Each topic of the subject has two sessions of laboratory practices. In them, the students will follow a tutorial / statement, as an example of programming on that topic or a work on software tools related to the current topic. Each group of students has to do, prior to the session behind closed doors, a preliminary work on the preparation of laboratory practice or a separate work in line with the topic. The session is used to evaluate the previous work done and complete it or perform a second part with the teacher's face-to-face support. The work is delivered at the end of the day of the practice session or later.

The virtual platform for communication is email and Microsoft Teams if required.

This subject, among other objectives, has to briefly introduce the student into modern concepts and technologies in part from a personal work not only of a student but also as a pre-engineer who will apply the knowledge acquired in this and other subjects to solve certain activities proposed throughout the course.

Within this, and to cover certain transversal competences (T02.05-Take own decisions, T06.03 Generate innovative and competitive proposals in the professional activity and T06.04 Manage information by incorporating critically the innovations of the professional field itself , and analyze the trends of the future), the practices of the subject will deal with the exposed topics, where based on a statement, the students will have to demonstrate their capacity to carry out the explained concepts generating a proposal of solution using the Technologyanalyzed in each case, and generating a report apart from the deliverables requested in each case. The report must contain, among others, the argumentation of why the student has opted for that solution, pros and cons and a projection (future lines) of possible improvements to it. In summary, the practices will be used to develop the knowledge acquired in each subject and to perform a work based on the competencies exposed.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practicum Sessions	12	0.48	2, 1, 3, 5, 4
Problems	12	0.48	2, 1
Theory	26	1.04	2, 1
Type: Autonomous			
Individual Study	40	1.6	2, 1
Practices preparation	52	2.08	2, 1

Assessment

The subject consists of 3 different subjects that will be assessed independently. To pass the whole subject, the 3 subjects must be passed with a minimum of 5 over 10. The mark of each topic is computed as:

- 45% individual assessment through a written test of that part,
- 5% individual assessment through one or several small problems proposed in theory or problems.
- 50% group assessment based on the result of the practice (previous work and laboratory session). It will be necessary to validate this note through a practice test that will be done the same days as the individual theory tests. If the validation is not exceeded, the note of the practice will be 0.

Both the theoretical and practical part of each topic must be approved separately with a minimum of 5 over 10 each.

In the case of failing any of the written tests, there is a recovery test at end of the semester. The practices are recoverable with a special exam / work.

The dates of continuous evaluation and delivery of works will be published on the virtual campus and may be subject to scheduling changes for reasons of adaptation to possible incidents.

In the case of failing only one of the three topics, and with a minimum of 3 in theory and 5 in practices in the failed subject, this failed topic could be convalidable with a fixed final grade of 4. To be able to validate the subject, the rest of the two topics must have a minimum mark of 6.

Students can keep notes of complete topics (theory + practices) from one course to another as long as the grade of the topic is at least 6 and the grade applied the next year will be a 5.
Granting an excellent "with honors" qualification (Matrícula de Honor (MH)) is the decision of the teacher responsible for the subject. UAB regulations state that MHs can only be awarded to students who have obtained a final grade equal to or higher than 9.00. Up to 5% MH of the total number of students enrolled can be awarded. They will be assigned by grade.
The stude will be grades with "Not avaluable" if no exam nor exercice nor practicum is presented.
For each assessment activity, a place, date and time of review will be indicated in which the student will be able to review the activity with the teacher. In this context, claims may be made on the grade of the activity, which will be evaluated by the teacher responsible for the subject. If the student does not appear for this review, this activity will not be reviewed later.

Without prejudice to other disciplinary measures deemed appropriate, and in accordance with current academic regulations, irregularities committed by a student that may lead to a variation in the grade in an assessable activity will be graded with a 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 course, this course will be suspended directly, without the opportunity to retake it in the same course. These irregularities include, but are not limited to:

- The total or partial copy of a practice, report, or any other evaluation activity.
- Let oneselfbe copied.
- Present a group work not done entirely by the group members (applied to all members, not just those who have not worked).
- Present as own materials prepared by a third party, even if they are translations or adaptations, and in general works with non-original and exclusive elements of the student.
- Have digital and / or communication devices (such as mobile phones, smart watches, camera pens, etc.) accessible during individual theoretical-practical assessment tests (exams).
- Talk to classmates during individual theoretical-practical assessment tests (exams).
- Observe / look at the theoretical-practical evaluation tests (exams) of other classmates during the performance of the same, even if the copy has not been carried out.
- Observe / look at the table, sheets, wall, etc., writings related to the subject during the realization of the theoretical-practical evaluation tests (exams) even if the copy has not been proceeded. With the exception of those provided, where appropriate, by teachers.

In case of not passing the subject due to the fact that some of the evaluation activities do not reach the required minimum mark, the numerical mark of the transcript will be the lower value between 4.5 and the weighted average of the marks. With the exceptions that the grade of "non-assessable" will be awarded to students who do not participate in any of the assessment activities, and that the numerical grade of the subject will be the lower value between 3.0 and the weighted average of the notes in case the student has committed irregularities in an act of evaluation (and therefore it will not be possible the pass the subject by compensation).

In short: copying, letting oneself be copied or plagiarizing (or attempting to) in any of the assessment activities amounts to a SUSPENSE with a grade below 3.0.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Group assessment	50%	0	0	2, 1, 3, 5, 4
Individual assessment	45%	4	0.16	2, 1
Individual assessment (Problems)	5%	4	0.16	2, 1, 3, 5, 4

Bibliography

- NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Pramod J. Sadalage , Martin Fowler. Addison-wesley, 2013.
- MongoDB: The Definitive Guide. Kristina Chodorow . O'Really , 2013.
- Big Data for Dummies . Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman. Wiley, 2013
- Big Data Analytics with Spark and Hadoop, Venkat Ankam, 2016
- Big-Data Analytics and Cloud Computing: Theory, Algorithms and Applications, Springer, 2016
- DevOps: A Software Architect's Perpective, Financial Times/Practice Hall, 2015
- Learning Puppet 4: A Guide to Configuration Management and , O'Reilly Media, 2016
- Docker Cookbook, Sebastien Goasguen, O'Reilly Media, 2015
- Creating Development Environments with Vagrant , packt publishing
- Scalable Internet Architectures, Theo Schlossnagle, Paperback, 2006
- The Art of Scalability: Scalable Web Architecture, Processes, and Organizations for the Modern Enterprise Paperback, Jun 2015

Software

MongoDB o MongoDB Atlas