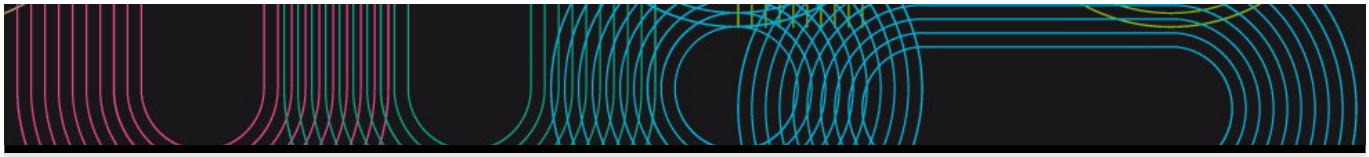

IDENTIFYING DATA				
Distributed Computing				
Subject	Distributed Computing			
Code	V05M145V01321			
Study programme	Máster Universitario en Ingeniería de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Mikic Fonte, Fernando Ariel			
Lecturers	Burguillo Rial, Juan Carlos Mikic Fonte, Fernando Ariel Rodríguez Hernández, Pedro Salvador			
E-mail	mikic@det.uvigo.es			
Web	http://moovi.uvigo.es			
General description	This course will provide a vision of group of the most usual technologies inside the distributed computing. They will tackle subjects such as the distributed transactions and the replication; the distributed artificial intelligence; and the parallel and evolutionary computing. We will use Spanish and Galician languages in classroom, and English language for the instructional materials.			

Training and Learning Results	
Code	
A2	CB2 Students must apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
A4	CB4 Students must communicate their conclusions, and the knowledge and reasons stating them-, to specialists and non-specialists in a clear and unambiguous way.
A5	CB5 Students must have learning skills to allow themselves to continue studying in largely self-directed or autonomous way
B8	CG8 Ability to apply acquired knowledge and to solve problems in new or unfamiliar environments within broader and multidiscipline contexts, being able to integrate knowledge.
C24	CE24/TE1 Ability to understand the fundamentals of distributed systems and distributed computing paradigms, and its application in the design, development and management in grid, ubiquitous computing scenarios and cloud systems.

Expected results from this subject	Training and Learning Results
To earn skills in the design, development and management of distributed systems.	A2 B8 C24
To understand the functional bases of the distributed systems.	A4 A5 C24
To know the distinct concepts related with the distributed computing.	A5 B8 C24
To earn skills for the application of intelligent systems in the distributed computing.	A2 A5 B8 C24

To learn how to distribute the execution of tasks for the resolution of problems and optimisation by means of evolutionary and parallel computing.	A2 A4 B8 C24

Contents	
Topic	
Theory 1. Distributed artificial intelligence	1. Intelligent agents and multiagent systems 2. Theory of games applied to multiagent systems: coordination, competition, negotiation, auctions, electronic trade 3. Complex distributed systems and auto-organised ones
Theory 2. Parallel and evolutionary computation	1. Distributed Computing and parallelization 2. Algorithms and evolutionary programming: genetics, memetics, differential evolution, intelligence of swarm. 3. Optimisation by means of evolutionary technics and parallelization
Theory 3. Transactions	1. Concurrency problems 2. Recoverability problems 3. Deadlocks 4. Optimistic concurrency control 5. Timestamps
Theory 4. Replication	1. Introduction to replication 2. Case studies of high available services (Bayou and Coda) 3. Transactions with replicated data
Theory 5. Design of distributed systems	1. Google case study
Practice 1. Multi-node cluster with Hadoop Distributed File System.	Part 1: Installation. Part 2: Developing a program analyzing Big Data using distributed Hadoop.
Practice 2: Introducing the basics for using evolutionary algorithms in optimization processes by means of parallel computing on Spark	Part 1: Evolutionary algorithms. Part 2: Decentralized evolutionary algorithms.

Planning	Class hours	Hours outside the classroom	Total hours
Lecturing	17	47	64
Project based learning	10	45	55
Report of practices, practicum and external practices	0	3	3
Objective questions exam	1	0	1
Objective questions exam	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	Description
Lecturing	Theoretical classes with practical cases. Besides, problems will be proposed for solving them in autonomous way (A5 and C24).
Project based learning	The students, in groups, will develop a software system with specific requirements. The follow-up of the project will be carried out during the B sessions (A2, A4, A5, B8).

Personalized assistance	
Methodologies	**Description**
Lecturing	Tutorships: Fernando A. Mikic Fonte: https://moovi.uvigo.gal/user/profile.php?id=11299 Pedro S. Rodríguez Hernández: https://moovi.uvigo.gal/user/profile.php?id=11584 Juan Carlos Burguillo Rial: https://moovi.uvigo.gal/user/profile.php?id=11297
Project based learning	The students, organized in groups, develop a project that addresses the design and implementation of a service-oriented architecture. Personalized attention related to these projects will take place in the sessions type B in the course. In each session of personalized attention, groups would discuss with the teacher the following questions concerning the progress of the project: What work has been addressed since the previous meeting?, What problems have been found?, What problems have not been solved?, and what is the planning of future work?

Assessment			
	Description	Qualification	Training and Learning Results

Project based learning	The students, organized in groups, will develop a solution to a software system with specific requirements.	35	A2 A4 A5	B8	
Report of practices, practicum and external practices	Detailed report of the tasks during the practices of laboratory carried out in group.	5	A4		
Objective questions exam	Series of short answer questions and/or multiple choice.	20	A5		C24
Objective questions exam	Series of short answer questions and/or multiple choice.	40	A5		C24

Other comments on the Evaluation

Students can, at ordinary exam, decide to be assessed according to a continuous assessment model or by global assessment. During the first week of the course, students must notify the subject coordinator about their choice. In case of choosing continuous assessment, a period of 1 month is offered to be able to renounce it. Once the students choose the continuous assessment model, their grade can never be "Not Submitted". For extraordinary exam the students will be evaluated using the modality of "global assessment" (some modifications over the original practices can be required). The scores obtained in ordinary exame are not preserved for extraordinary exam.

Plagiarism and copying are not allowed. In the event of detection of plagiarism or copying in any of the tests, the final grade will be FAIL (0) and the fact will be communicated to the Center's management for appropriate purposes.

1- CONTINUOUS ASSESSMENT

To pass the course requires a minimum score of 5 points. The score will be the result to add the scores received in each one of the following parts:

- Exam 1:
  - Dates: Approved in the Comisión Académica de Grado (CAG), they will be available at the beginning of the academic semester.
  - Individually
  - Contents: Theoretical content given until this moment
  - Type: Series of short answer questions and/or test type ones
  - Maximum score = 2 points
- Exam 2:
  - Dates: Official calendar (coinciding with the global assessment for those that opted by this modality)
  - Individually
  - Contents: Theoretical content given until this moment excepting those that already were assessed in the Exam 1.
  - Type: Series of short answer questions and/or test type ones
  - Maximum score = 4 points
- Practice:
  - Dates: Throughout the semester (not being compulsory practices).
  - In group:
    - Reports / memories of practice and Laboratory practice: A personalized score is asigned to each member of the group according to the following:
    - Final score of practices = (Memory + Practice) * Weighting factor
      - Memory maximum score = 0.5 points
      - Practice maximum score = 3.5 points (verification of the correct operation of the practice and of possible changes to be made in it, in group or individually).
      - Weighting factor = (Follow-up by the teacher + Peers assessment) / 20
        - Follow-up by the teacher: About the work carried out by each student observed by the teacher (0-10)
        - Peers assessment: Within each group. Each student asseses his/her partners about the work they did (0-10). Then, an arithmetic average is calculated for each student.
  - Maximum score= 4 points

2- GLOBAL ASSESSMENT AND END-OF-PROGRAM EXAM

To pass the course requires a minimum score of 5 points.

- Theoretical exam:
  - Dates: Official calendar
  - Individually
  - Contents: Given in the whole theoretical part of the course.
  - Type: Series of short answer questions and/or test type ones
  - Maximum score= 6 points

- Practice exam and delivery of practice:
  - Dates of the exam: Official calendar
  - Dates of the delivery of practice: Before the exam.
  - Individually.
  - Type: Verification of the correct operation of the practice and of possible changes to be made in it.
  - Maximum score= 4 points

Sources of information

Basic Bibliography

George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, **Distributed systems. Concepts and design**, 5, Addison Wesley, 2011

Michael Wooldridge, **An Introduction to Multiagent Systems**, 2, Addison-Wesley, 2009

A.E. Eiben, J.E. Smith, **Introduction to Evolutionary Computing (Natural Computing Series)**, 2, Springer, 2015

Tom White, **Hadoop: The Definitive Guide**, 3, O'Reilly Media, 2012

Complementary Bibliography

Thomas Rauber, Gudula Rúnger, **Parallel Programming for Multicore and Cluster Systems**, 2, Springer, 2013

Recommendations

Subjects that it is recommended to have taken before

Application Technologies/V05M145V01105