



## Teaching Guide

Identifying Data					2023/24
Subject (*)	Multiagent Systems	Code	614544005		
Study programme	Máster Universitario en Intelixencia Artificial				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	2nd four-month period	First	Optional	6	
Language	English				
Teaching method	Face-to-face				
Prerequisites					
Department	Ciencias da Computación e Tecnoloxías da Información				
Coordinador	Sanchez Maroño, Noelia	E-mail	noelia.sanchez@udc.es		
Lecturers	Alvarez Estevez, Diego Sanchez Maroño, Noelia	E-mail	diego.alvareze@udc.es noelia.sanchez@udc.es		
Web	campusvirtual.udc.gal				
General description	The main objective of this subject is to learn to distinguish the appropriate problems for designing multi-agent systems, as well as their main characteristics. The concept of an intelligent agent is introduced. The main theories and models will be detailed, as well as the various architectures of multi-agent systems and their most relevant applications.				

## Study programme competences / results

Code	Study programme competences / results
A6	CE05 - Ability to design and develop intelligent systems through the application of inference algorithms, knowledge representation and automated planning
A7	CE06 - Ability to recognise those problems that require a distributed architecture, not predetermined during the system design, suitable for the implementation of multiagent systems
A8	CE07 - Ability to understand the consequences of the development of an explainable and interpretable intelligent system
A9	CE08 - Ability to design and develop secure intelligent systems, in terms of integrity, confidentiality and robustness
B1	CG01 - Maintaining and extending theoretical foundations to allow the introduction and exploitation of new and advanced technologies in the field of AI
B2	CG02 - Successfully addressing each and every stage of an AI project
B3	CG03 - Searching and selecting that useful information required to solve complex problems, with a confident handling of bibliographical sources in the field
B6	CB01 - Acquiring and understanding knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, frequently in a research context
B7	CB02 - The students will be able to apply the acquired knowledge and to use their capacity of solving problems in new or poorly explored environments inside wider (or multidisciplinary) contexts related to their field of study
B8	CB03 - The students will be able to integrate different pieces of knowledge, to face the complexity of formulating opinions (from information that may be incomplete or limited) and to include considerations about social and ethical responsibilities linked to the application of their knowledge and opinions
B9	CB04 - The students will be able to communicate their conclusions, their premises and their ultimate justifications, both to specialised and non-specialised audiences, using a clear style language, free from ambiguities
C2	CT02 - Command in understanding and expression, both in oral and written forms, of a foreign language
C3	CT03 - Use of the basic tools of Information and Communications Technology (ICT) required for the student's professional practice and learning along her life
C4	CT04 - Acquiring a personal development for practicing a citizenship under observation of the democratic culture, the human rights and the gender perspective
C5	CT05 - Understanding the importance of the entrepreneurial culture and knowledge of the resources within the entrepreneur person's means
C6	CT06 - Acquiring abilities for life and healthy customs, routines and life styles



C7	CT07 - Developing the ability to work in interdisciplinary or cross-disciplinary teams to provide proposal that contribute to a sustainable environmental, economic, political and social development
C8	CT08 - Appreciating the importance of research, innovation and technological development in the socioeconomic and cultural progress of society

Learning outcomes			
Learning outcomes	Study programme competences / results		
Introduce the concept of multi-agent systems based on the need for distributed architectures in intelligent systems	AC6 AC7 AC8	BC1 BC9	CC3 CC6 CC8
Understand the different approaches to intelligent agent architectures	AC5 AC6	BC1 BC6 BC7	
Understand the notion of negotiation as a simple aspect inherent to multi-agent systems.	AC6 AC7	BC6 BC7	
Understand the notions and basic aspects of communication, coordination and cooperation.	AC6 AC7	BC8	
Analyze the various existing methodologies for the development of multi-agent systems.	AC5 AC6	BC2 BC8	CC2
Know applications of this type of systems in industrial, medical, computer environments, etc.	AC6	BC3 BC6 BC7	CC4 CC5 CC7

Contents	
Topic	Sub-topic
Introduction	Intelligent agent concept Multiagent system
Agent architectures	Deliberative architectures Reactive architectures Hybrid architectures
Interaction between agents	Communication Negotiation Cooperation Coordination
Agent-oriented methodologies	Adaptation of existing methodologies Agent-oriented methodologies
Applications	Industry Medicine Computer science

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Laboratory practice	A6 A9 B2 C3 C6 C7	14	30	44
Problem solving	A7 B1 B3 B7 C4 C5	7	39	46
Oral presentation	B9 C2	1	1	2
Guest lecture / keynote speech	A8 B8 C8	21	17	38
Supervised projects	A9 A6 B3 C7 C3	0	18	18



Objective test	B6 B8 C2	2	0	2
Personalized attention		0		0

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Laboratory practice	The practical classes will consist of developing a basic multiagent system (MAS) or some specific parts of it. The delivery may have different deadlines to encourage continuous work. The practical instructions will be provided in advance for students to read in detail, and they must be strictly followed. Later, the work of the teachers will be to supervise the practical sessions, resolving doubts and correcting misinterpretations, errors, etc
Problem solving	In the problem classes, practical assumptions will be presented directly related to theoretical concepts. The students will have to look for alternative solutions outside the classroom. The aim is to encourage student participation and promote, as far as possible, open dialogue and the assessment of solutions.
Oral presentation	For some practical or problem, students must prepare a presentation where they expose their work in the classroom, highlighting the main contributions and conclusions.
Guest lecture / keynote speech	Oral presentation supplemented with the use of audiovisual media and introduction of some questions addressed to students for the purpose to transmit knowledge and facilitate learning.
Supervised projects	Various supervised projects related to the practical part of the subject will be carried out. These projects present situations that require the student to identify the problem under study, formulate it precisely, develop the relevant procedures, apply the techniques seen in class, interpret the results and draw the appropriate conclusions from the work done.
Objective test	It will consist of theoretical-practical questions about any of the concepts included in the course agenda.

Personalized attention	
Methodologies	Description
Laboratory practice Problem solving	<p>The adequate progress of the students will determine the development of master classes, problem-solving classes, and practical labs.</p> <p>Laboratory practicals will be carried out, primarily, as autonomous work. For its proper development, it will be necessary to monitor periodically the students' work to clarify errors and concepts as soon as possible and ensure the quality of work.</p> <p>Outside class hours, the official tutoring hours allow personalized attendance through the following channels:</p> <ul style="list-style-type: none"> <li>- E-mail: Use for short answer queries.</li> <li>- Teams: virtual meetings (upon request via e-mail)</li> </ul>

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Objective test	B6 B8 C2	It will consist of theoretical and practical questions on any of the items included in the contents (minimum grade 4)	40
Laboratory practice	A6 A9 B2 C3 C6 C7	Realization of the tasks, in time and form, is established in the instructions of any proposed practical. To pass the subject is essential to have made and approved the practicals (minimum grade 4). As part of it, issues such as school attendance, personal work, attitude, etc. will help to pass the practicals.	40
Supervised projects	A9 A6 B3 C7 C3	The completion of these projects, in time and form, is established in the instructions of any proposed assignment. To pass the subject it is essential to have carried out and approved these projects (minimum grade 4). Issues such as attendance, personal work, attitude, etc. will help to approve the project	20



Oral presentation	B9 C2	It could be included in some problem solving/laboratory practice and it would affect the final grade of it, however it is not graded on its own.	0
-------------------	-------	--	---

### Assessment comments

All continuous assessment tests (practices, supervised projects and tests) have a minimum grade of 4 that can be offset with other grades, but it is mandatory to obtain a minimum grade of 5 to pass the subject.

In the case of "Fail" or "Not presented" at the first opportunity, those laboratory practices or supervised works not presented or failed during the course may be resubmitted, in no case is it possible to resubmit these practices or works to achieve a better grade.

The fraudulent performance of tests or assessment activities, once verified, will directly involve the qualification of Fail in the call in which it is committed: the student will be qualified with "Fail" (numerical grade 0) in the corresponding call of the academic year, both if the offense is committed in the first opportunity as in the second. For this, the qualification will be modified in the first opportunity report, if necessary\*

\* UDC student disciplinary regulation. Approved by Consello de Goberno do 27/02/2023 and modified in its article 11.4.b by Consello de Goberno on 06/28/2023

### Sources of information

<b>Basic</b>	<ul style="list-style-type: none"><li>- Gerhard Weiss (2013). Multiagent Systems, Second Edition. MIT Press</li><li>- Adelinde M. Uhrmacher, Danny Weyns (2009). Multi-Agent Systems Simulation and Applications. Routledge, Taylor &amp; Francis Group</li><li>- Michael Wooldridge (2009). An introduction to multiagent systems. Wiley</li></ul>
<b>Complementary</b>	

### Recommendations

#### Subjects that it is recommended to have taken before

AI Fundamentals/614544001  
Reasoning and Planning /614544003

#### Subjects that are recommended to be taken simultaneously

#### Subjects that continue the syllabus

#### Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.