UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: INTELLIGENT SYSTEMS
Code: 42321
Type: CORE COURSE
ECTS credits: 6
Degree: 406 - UNDERGRADUATE DEGREE IN COMPUTER SCIENCE AND ENGINEERING (AB)
Academic year: 2022-23
Center: 604 - SCHOOL OF COMPUTER SCIENCE AND ENGINEERING (AB)
Group(s): 10 11 12
Year: 3
Duration: First quarter
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: N
Web site:
Bilingual: Y

Lecturer: **MARIA JULIA FLORES GALLEGO** - Group(s): **12**

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Lecturer: **JOSE ANTONIO GAMEZ MARTIN** - Group(s): **11**

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Lecturer: **ISMAEL GARCIA VAREA** - Group(s): **10 11**

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2. Pre-Requisites

This subject requires the capability for working with abstract concepts, and some skills for autonomous problem-solving.

In relation to previous subjects in the degree, it requires:

- Basic knowledge of discrete maths and probability theory.
- Capability for stating and solving problems through logic (first-order logic, inference, resolution, etc.)
- Knowledge of basic data structures (trees, graphs, etc.) and algorithms that manage them.
- Knowledge of basic algorithm techniques, principles of software engineering, analysis of computational complexity.
- Fluency in programming with high-level OOP languages (e.g. Java).

Capability of working in groups is also required.

3. Justification in the curriculum, relation to other subjects and to the profession

This subject introduces the basic techniques of Artificial Intelligence in the degree. Such techniques are often required nowadays for the solution of complex problems: decision making, diagnose systems, control and monitoring, web search, semantic web, recommender systems, machine learning, data analysis and mining, vision, robotics, etc.

The subject certainly requires some other previous subjects in the program - discrete maths, logic, programming- and is a prerequisite for some other posterior subjects such as data mining, knowledge based systems, multi agent systems, artificial intelligence, or robotics.

It is also a co-requisite which allows defining a software project with some other subjects such as information systems, data bases or software engineering.

4. Degree competences achieved in this course

Course competences

Code	Description
BA04	Basic knowledge about the uses and programming of computers, operating systems, data bases, and digital programmes with applications in engineering.
CO15	Knowledge and application of fundamental principles and basic techniques on intelligent systems and their practical applications.
INS01	Analysis, synthesis, and assessment skills.
SIS01	Critical thinking.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Knowledge about the basic principles and techniques of intelligent systems and their practical application.

Additional outcomes

Solving problems by using uniformed and informed search. Selection of the right technique for a given problem.

Knowledge on combinatorial optimization problems. How to define them.

Knowledge on population-based metaheuristics, basically genetic algorithms. Application to real-world problems.

Knowledge on local-search metaheuristics.
Design and implementation of adversarial search algorithms.
Knowledge on rule-based systems. Main components and architectures.
Solving problems by using machine learning.
Knowledge on basics algorithms for supervised and un-supervised classification.

6. Units / Contents

Unit 1: Introduction.
Unit 2: State-space search.
Unit 3: Heuristic search.
Unit 4: Adversarial search.
Unit 5: Learning agents.
Unit 6: Combinatorial optimization problems.
Unit 7: Metaheuristics: local search
Unit 8: Metaheuristics: genetic algorithms.
Unit 9: Machine learning.
Unit 10: Supervised classification: rules and trees.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CO15	1.12	28	N	-	Lectures will be supported by presentations/slides. Apart from class lectures, depending on the corresponding unit/content other activities could be carried out: puzzle, seminar, workgroup, etc.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CO15 INS01 SIS01	0.32	8	N	-	In-class resolution of exercises.
Class Attendance (practical) [ON-SITE]	Combination of methods	BA04 CO15	0.24	6	N	-	In the laboratory, the students will develop a global practice/lab assignment in an incremental way. This can be seen as divided into smaller parts/tasks each of them of certain importance and weight (several weeks of work each of them). Each part or assignment will consist of the resolution of the same problem (which can be re-adapted according to the case) by using distinct paradigms from Intelligent Systems. Each one of the lab assignments will be introduced in the first lab session this assignment is started. In these activities we also include the support to students that will be provided in class during the development of the assignments, replying to the questions that may arise when developing the corresponding tasks. Continuous Assessment (C): two submission deadlines mid-term (30%, report non-necessary) and end-term (70%, with a report for all the labs) NC: Before the official exam (in January), it will include additional assignments wrt C. If a student submits the lab assignments in December (C), they voluntarily discard the possibility of NC. So, if fail, they go directly to the extra session in the practical/lab side of the course.
Computer room practice [ON-SITE]	Project/Problem Based Learning (PBL)	BA04 CO15 INS01	0.48	12	Y	Y	Worked developed by the student in the laboratory, supervised by the professor.
Study and Exam Preparation [OFF-SITE]	Self-study	CO15 INS01 SIS01	1.44	36	N	-	By using the available materials provided in the course, and supported by the classes and explanations offered by the professor, the students must carry out their own study and preparation. The knowledge acquired must be also used for exercise solving.
							Resolution of problems and study cases from class related to the distinct units. Students will be

Writing of reports or projects [OFF-SITE]	Problem solving and exercises	CO15 INS01 SIS01	0.96	24	Y	N	provided a list of selected exercises to work on them. The submission and associated (valuable) comments about the exercises both in class and in the online forum, done voluntarily, will be assessed as in-class participation. This activity is individual.
Practicum and practical activities report writing or preparation [OFF-SITE]	Individual presentation of projects and reports	CO15 INS01 SIS01	0.48	12	Y	Y	Related to the lab assignments, a lab report must be presented. In this document, the student will generally describe the implemented agents, and the problem, also including a proper comparison of the performance, alternative configurations, and general analysis. The content will be very important (structure, writing, spelling, plots,...) [INS01]. One oral interview will be required in order to complement the assessment of the submitted report(s). C: submission is done in December, end-term. NC: submission is done in January, before the official exam.
Other off-site activity [OFF-SITE]	Practical or hands-on activities	BA04 CO15 INS01 SIS01	0.72	18	Y	N	Additional hours (apart from in-class) to complete the lab assignments/programming projects.
Analysis of articles and reviews [OFF-SITE]	Reading and Analysis of Reviews and Articles	CO15 INS01 SIS01	0.24	6	N	-	We will provide additional material that will help to put in context, justify, and broaden the course contents.
		Total:	**6**	**150**			
		Total credits of in-class work: 2.16					**Total class time hours: 54**
		Total credits of out of class work: 3.84					**Total hours of out of class work: 96**

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Laboratory sessions	30.00%	30.00%	[ESC][LAB] Development, submission and (individual) interview of the distinct tasks/assignments proposed in the course. It is compulsory to get a minimum grade (4 up to 10) to apply the final formula, and then be able to pass the course. For this minimum we will consider the grade of the end-term submission (C), which somehow includes the mid-term submission, or the single submission in NC assessment. C: Two submissions: mid-semester (30%) and end-semester (70%). NC: One single submission (deadline before the official exam), which will include additional parts not present in Continuous modality. (Those students submitting in December are giving up NC modality in the practical side)
Final test	50.00%	60.00%	[ESC] Individual and written exam that must be carried out by all students. It is mandatory to obtain a minimum grade (4/10) to be able to pass the course. This is the same test for continuous and non-continuous evaluation (C and NC).
Practicum and practical activities reports assessment	10.00%	10.00%	[LAB 50%] [INF 50%] Competence related with synthesis must be acquired in this course. Therefore, we will evaluate the report(s) that describe the solutions to the different assignments. We will consider correctness, structure, spelling, grammar, expression, vocabulary, etc. Plots, diagrams, etc., will be evaluated positively if used properly. It is compulsory to get a minimum of 4 (up to 10) to be able to pass this course. C: It will be submitted with the second submission of the lab assignment, end-term (December). NC: It will be submitted with the lab NC lab assignment (January). It must include also the information and analysis of the additional tasks in NC modality.
Assessment of active participation	10.00%	0.00%	[ESC] This 10% of the grade corresponds to participation in-class and in onlie activities/forums. The aim is solving, sharing, debating, discussing in class and/or in the virtual space about the problems (exercises or cases) proposed. This is individual and voluntary,

			without a minimum grade required. (C) NC: Not Applicable
Total:	**100.00%**	**100.00%**	

According to art. 6 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 13.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

- In-class participation and collaborations in forums assume the contribution of novel solutions and critical discussions related to proposed topics. On some occasions, the students will submit exercises done in class. This is a voluntary/optional activity, and the course could be passed without participating here.

- Lab assignments must be submitted and defended in the lab session established for that. It will be required that the students pass the interview regarding each assignment. To compensate for other activities the grade of the end-term (C) or unique (NC) submission in lab assignments must be >=4.

In NC assessment you will be asked some additional tasks with respect to the lab statement in the continuous evaluation, and these extra parts must be solved in the code and included in the report.

- The lab report(s) must be submitted by the required deadline. It will be required that the students present it and/or they are interviewed regarding each assignment. To compensate for other activities the average grade related to the report be >=4.

- For the theoretical part, the corresponding test will take place on the official date for this course exam in regular session. It is required to get at least 4 (up to 10) in this part in order to pass the subject (grade >= 4).

- The final grade is obtained as 0.5*theory + 0.3*lab_assignments + 0.1*report + 0.1*participarion
as long as the required minimum grades for theory, practice, and report are reached. Otherwise, the final grade is computed as minimum(4.0, theory-grade) if the theoretical exam is done or NO-PRESENTADO (no show) if this exam is not done.

Originality: The submission of any exercise (exam, lab report, programming code, resolution of a problem, etc.) directly implies authorship from the students involved. So, appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty (cheating, plagiarism, ...) in this direction.

By default, the student will be evaluated by continuous assessment. If someone wishes to move to non.continuous assessment, this should be explicitly indicated through the link https://www.esiiab.uclm.es/alumnos/evaluacion.php before finishing the teaching lectures of the term/semester, as long as the student hasn't already be assessed from 50% or more in the continuous modality.

Non-continuous evaluation:

The assessment of the course will consist of:

- Theoretical exam: 60% (it is a requirement to obtain a grade >=4 to compensate)
- Lab assignments (practice): 30% (it is a requirement to obtain a grade >=4 to compensate)
- Lab report (practice): 10% (it is a requirement to obtain a grade >=4 to compensate)

The tasks/assignments will imply the same work as Continuous Modality, plus other additional tasks, which affects the programming work and the report.

- The final grade of the course is:
final-grade = 0.6*theory + 0.3*practice + 0.1*report
as long as the required minimum grades for theory, practice and report are reached. Otherwise, the final grade is computed as minimum(4.0, theory-grade)

Originality: The submission of any exercise (exam, lab report, programming code, resolution of a problem, etc.) directly implies authorship from the students involved. So, appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty (cheating, plagiarism, ...) in this direction.

Specifications for the resit/retake exam:

It follows the same scheme described for non-continuous evaluation.

Specifications for the second resit / retake exam:

It follows the same scheme described for non-continuous evaluation.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	8
Class Attendance (practical) [PRESENCIAL][Combination of methods]	6
Computer room practice [PRESENCIAL][Project/Problem Based Learning (PBL)]	12
Study and Exam Preparation [AUTÓNOMA][Self-study]	6
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	24
Practicum and practical activities report writing or preparation [AUTÓNOMA][Individual presentation of projects and reports]	18
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	6

General comments about the planning: This course schedule is APPROXIMATE. It could vary throughout the academic course due to teaching needs, bank holidays, etc. A weekly schedule will be properly detailed and updated on the online platform (Virtual Campus) Note that all the lectures, practice sessions, exams and related activities performed in the bilingual groups will be entirely taught and assessed in English. Classes will be scheduled in 3 sessions of one hour and a half per week. Evaluation activities or catch-up classes may exceptionally be scheduled in the afternoon (morning).

Unit 1 (de 10): Introduction.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.5

Unit 2 (de 10): State-space search.

Activities	**Hours**

Class Attendance (theory) [PRESENCIAL][Lectures]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Unit 3 (de 10): Heuristic search.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Unit 4 (de 10): Adversarial search.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Unit 5 (de 10): Learning agents.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	6
Unit 6 (de 10): Combinatorial optimization problems.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Unit 7 (de 10): Metaheuristics: local search	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	3
Unit 8 (de 10): Metaheuristics: genetic algorithms.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	4.5
Unit 9 (de 10): Machine learning.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Unit 10 (de 10): Supervised classification: rules and trees.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	4.5
Global activity	
Activities	**hours**
Study and Exam Preparation [AUTÓNOMA][Self-study]	42.5
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	28.5
Practicum and practical activities report writing or preparation [AUTÓNOMA][Individual presentation of projects and reports]	18
Analysis of articles and reviews [AUTÓNOMA][Reading and Analysis of Reviews and Articles]	6
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	8
Computer room practice [PRESENCIAL][Project/Problem Based Learning (PBL)]	12
Class Attendance (theory) [PRESENCIAL][Lectures]	29
Class Attendance (practical) [PRESENCIAL][Combination of methods]	6
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	City	ISBN	Year	Description
Palma Méndez, José T.; Marín Morales, Roque Luis	Inteligencia artificial : técnicas, métodos y aplicaciones http://www.mcgraw-hill.es/html/8448156188.html	McGraw Hill		978-84-481-5618-3	2008	
Nilsson, Nils J.	Inteligencia artificial : una nueva síntesis	McGraw Hill		84-481-2824-9	2000	
Russell, Stuart J.	Inteligencia artificial : un enfoque moderno http://aima.cs.berkeley.edu/	Pearson		978-84-205-4003-0	2007	
Russell, Stuart J.	Artificial intelligence: a modern approach (4th edition) http://aima.cs.berkeley.edu/	Pearson Education		978-1292401133	2021	