ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

615000246 – Artificial Intelligence

DEGREE PROGRAMME

61IW – Degree in Software Engineering

ACADEMIC YEAR & SEMESTER

2023/24 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	615000246 -Artificial Intelligence
No of credits	3 ECTS
Type	Mandatory
Academic year ot the programme	Second year
Semester of tuition	Semester 3rd
Tuition period	September-January
Tuition languages	English
Degree programme	61IW – Software Engineering Bachelor
Centre	61 - Escuela Tecnica Superior De Ingenieria De Sistemas Informaticos
Academic year	2023-24

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Cristian Oliver Ramírez Atencia (Subject coordinator)	1108	cristian.ramirez@upm.es	To be confirmed.

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The curriculum for the bachelor's degree in software engineering does not have any specified recommended prerequisites for this subject.

3.2. Other recommended learning outcomes

Given the focus of the subject and the specificity of the topics covered, no recommended prior knowledge is defined.

4. Skills and learning outcomes *

4.1. Skills to be learned

CB1 - Ability to solve mathematical problems that may arise in engineering. Proficiency in applying knowledge of algebra, differential and integral calculus, and numerical methods; statistics, and optimization.

CB3 - Ability to understand and master the basic concepts of discrete mathematics, logic, algorithmics, and computational complexity, and their application for automatic information processing through computer systems, and their application for problem-solving in engineering.

CC1 - Ability to design, develop, select, and evaluate computer applications and systems, ensuring their reliability, security, and quality, following ethical principles and current legislation and regulations.

CC15 - Knowledge and application of the fundamental principles and basic techniques of intelligent systems and their practical application.

CC6 - Knowledge and application of basic algorithmic procedures of information technology to design solutions for problems, analyzing the suitability and complexity of the proposed algorithms.

CT5 - Organization and planning: Effectively identify and define the goals, objectives, and priorities of a task or project by stipulating the activities, deadlines, and required resources, while monitoring the established processes.

4.2. Learning outcomes

RA65 - Presents novel resources, ideas, and methods translated into actions. Resolves situations or problems in the field of engineering in a new and original way.

RA62 - Knows the most relevant techniques of AI, both symbolic and subsymbolic.

RA61 - Knows when AI techniques should be used to address a problem.

RA63 - Proposes possible solutions to a problem that requires AI.

RA83 - Performs a complex task autonomously, selecting the most appropriate strategies to approach the study based on the analysis of conditions and the proposed goal. Analyzes and interprets information, handles information and communication technologies (ICTs), demonstrates communication and interaction skills for collaborative learning. Values the effectiveness of task planning and makes timely decisions to achieve the purpose.

RA64 - Identifies which AI techniques are present in various everyday use products.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

Artificial Intelligence is a very difficult concept to define, mainly because while "artificial" implies "made by humans," the concept of "intelligence" is very elusive. When can we define something as intelligent? Is a stone intelligent? It doesn't seem so. What about a human? Generally, yes. An ant, a cat? Perhaps also. A thermostat? It doesn't seem like it, but... why? A thermostat "senses" cold and heat and acts accordingly. Where is the boundary? Is intelligence inherently linked to the concept of "natural," or can it be detached?

This subject serves as an entry point to this fascinating field. It will cover some of its fundamentals, a bit of history, and present unanswered questions. Subsequently, the most relevant techniques within the area will be studied: search in state spaces, evolutionary computation, neural networks, and fuzzy logic. Besides their basic principles, their interrelationships will be identified, and problems requiring solutions based on these techniques will be proposed.

5.2. Syllabus

1. Introduction
1.1. Fundamentals
1.2. History
1.3. Problems of Artificial Intelligence

2. Exploration in State Spaces
2.1. State Spaces
2.2. Search Algorithms
2.3. Zero-Sum Games: Minimax

3. Evolutionary Computation
3.1. Introduction
3.2. Genetic Algorithms

4. Machine Learning
4.1. Supervised and Unsupervised Learning
4.2. Artificial Neural Networks

5. Fuzzy Logic
5.1. Fundamentals
5.2. Fuzzy Reasoning Systems

6. Schedule

6.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	**Subject presentation** Lecture **Chapter 1.**			
2		**"Practice 1 - Introduction to Python** **Duration: 02:00** **PL: Laboratory Practice Activity"**		
3	**Topic 2 - Exploration in State Spaces** **Duration: 02:00** **LM: Master Lecture Activity**			
4	**Topic 2 - Exploration in State Spaces** **Duration: 02:00** **LM: Master Lecture Activity**			
5	**Topic 2 - Exploration in State Spaces** **Duration: 01:00** **PR: Problem Class Activity**			
6	**Topic 3 - Evolutionary Computation** **Duration: 02:00** **LM: Master Lecture Activity**			Moodle Quiz ET: Telematic Test Technique Continuous Assessment Non-Presential Duration: 00:30 (30 minutes)
7	**Topic 3 - Evolutionary Computation** **Duration: 02:00** **PR: Problem Class Activity**			
8		**Practice 2 - Heuristic Search and Evolutionary Computation** **Duration: 02:00** **PL: Laboratory Practice Activity**		
9	**Topic 3 - Machine Learning** **Duration: 02:00** **LM: Master Lecture Activity**			Moodle Quiz ET: Telematic Test Technique Continuous Assessment Non-Presential Duration: 00:30 (30 minutes)
10	**Topic 3 - Machine Learning** **Duration: 02:00** **LM: Master Lecture Activity**			

11	**Topic 3 - Machine Learning** **Duration: 02:00** **LM: Master Lecture Activity**			
12	**Topic 4 - Fuzzy Logic** **Duration: 02:00** **LM: Master Lecture Activity**			Moodle Quiz ET: Telematic Test Technique Continuous Assessment Non-Presential Duration: 00:30 (30 minutes)
13	**Topic 4 - Fuzzy Logic** **Duration: 02:00** **LM: Master Lecture Activity**			Practice 2 Submission TG: Group Work Technique Continuous Assessment and Final Exam Only Non-Presential Duration: 02:00 (2 hours)
14		**Practice 3 - Artificial Neural Networks and Fuzzy Logic** **Duration: 02:00** **PL: Laboratory Practice Activity**		
15	**AI Exercises** **Duration: 02:00** **PR: Problem Class Activity**			Moodle Quiz ET: Telematic Test Technique Continuous Assessment Non-Presential Duration: 00:30 (30 minutes)
16				
17				Examination ET: Written Exam Technique Continuous Assessment In-Person Duration: 02:00 (2 hours) Examination ET: Written Exam Technique Final Exam Only Assessment In-Person Duration: 02:30 (2 hours and 30 minutes)

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Moodle Quiz	ET: Telematic Test Technique	Non-Presential	00:30	5%	/10	CB3 CC15
7	Moodle Quiz	ET: Telematic Test Technique	Non-Presential	00:30	5%	/10	CB3 CC15
7	Moodle Quiz	ET: Telematic Test Technique	Non-Presential	00:30	5%	/ 10	CB3 CC15
15	Practice 2 Submission	TG: Group Work Technique	Non-Presential	02:00	20%	/ 10	CB1 CC6 CC15
15	Moodle Quiz	ET: Telematic Test Technique	Non-Presential	00:30	5%	/10	CB3 CC15
15	Test	Written exam	Face to face	02:00	60%	4/10	CT5 CB1 CB3 CC1 CC6 CC15

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
13	Practice 2 Submission	TG: Group Work Technique	Non-Presential	02:00	20%	/ 10	CB1 CC6 CC15
17	Test	Written exam	Face to face	02:00	80%	5/10	CT5 CB1 CB3 CC1 CC6 CC15

7.1.3. Referred (re-sit) examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills

	CT Global Examination.	Written exam	Face-to-face	02:30	100%	5/ 10	CT5 CB1 CB3 CC1 CC6 CC15

7.2. Assessment criteria

The evaluation criteria used in the subject will be as follows, for the three available types of assessment:

- Written Exam: The written exam will consist of two practical exercises randomly selected from the explained techniques. A minimum grade is required to count towards the final grade. To be considered for the final grade, a minimum score of 4 out of 10 is necessary.

- Quizzes: There is no minimum grade required in the quizzes for them to contribute to the final grade. Each quiz will contribute 5% to the final grade.

- Practice: There is no minimum grade required in the practical work for it to count towards the final grade. The practice will contribute 20% to the final grade.

- It will be necessary to obtain at least a 4 out of 10 on the written exam for it to count towards the final grade. The exam will contribute 60% to the final grade if the score is above 4 out of 10. Otherwise, it will contribute 0% to the final grade.

To pass the subject, a minimum score of 5 out of 10 is required in the sum of all evaluation activities.

For students who have not passed the previous assessments, they have the option to take a final comprehensive evaluation.

Extraordinary Evaluation:

An optional practical assessment corresponding to the extraordinary session will be published on Moodle. All students who wish to do so can take it. If completed, it will replace the grade of the January session.

Students who want to retake the theoretical part of the subject (quizzes) can take a theory test on the same day as the exam. If taken, it will replace the previous grade of the quizzes.

The written exam will consist of two practical exercises randomly selected from the explained techniques.

- There is no minimum grade required in the quizzes for them to contribute to the final grade. Each quiz will contribute 5% to the final grade.

- There is no minimum grade required in the practical work for it to count towards the final grade. The practice will contribute 20% to the final grade.

- To count towards the final grade, a minimum score of 4 out of 10 is required in the written exam. The exam will contribute 60% to the final grade if the score is above 4 out of 10. Otherwise, it will contribute 0% to the final grade.

In summary, the subject will be considered passed if a total score of at least 5 out of 10 is achieved in all evaluation activities.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Moodle UPM	Web resource	The whole pack of documentation and examples used in class by the teacher. It is documentation elaborated by the teacher
S. Russell, P. Norvig (2009) Artificial Intelligence: A Modern Approach, Pearson (3rd edition). P.H. Winston (1992) Artificial Intelligence,	Bibliography	Basic book for reference.
Python 3	Bibliography	https://docs.python.org/3/tutorial/

9. Other information