



GENERAL INFORMATION

Data of the subject	
Subject name	Algorithms and Data Structures
Subject code	DTC-IMAT-120
Mainprogram	N/A [GiMAT 26]
Involved programs	Grado en Ingeniería Matemática e Inteligencia Artificial [First year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	6,0 ECTS
Type	Básico
Department	Department of Telematics and Computer Scienes

Teacher Information	
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites
Basic Programming Fundamentals



Course contents

Contents

Topic 0: Course introduction and planning

Topic 1: Introduction to algorithm development

- Introduction to algorithm development. Computing, programs, and algorithm design.

Topic 2: Algorithm design strategies

- Brute force
- Divide and conquer
- Recursion

Topic 3: Complexity analysis (algorithmic complexity)

- Efficiency
- Asymptotic notation
- Analysis and complexity classes

Topic 4: Algorithms and Data structures

- Introduction to data structures
- Arrays, lists, tuples
- Stacks, queues, linked lists
- Hash tables

Topic 5: Sorting algorithms

- Types of algorithms based on behavior
- Basic algorithms: direct methods, insertion, selection, and exchange algorithms
- Advanced algorithms

Topic 6: Search algorithms and heaps

- Introduction
- Binary search trees
- Basic operations
- Red-black trees
- Heaps
- Complexity of operations

Topic 7: Advanced strategies and algorithms

- Greedy programming



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- Backtracking
- Dynamic programming
- Tabulation and memoization techniques

EVALUATION AND CRITERIA

The use of AI to produce full assignments or substantial parts thereof, without proper citation of the source or tool used, or without explicit permission in the assignment instructions, will be considered plagiarism and therefore subject to the University's General Regulations.

Evaluation activities	Evaluation criteria	Weight
Mid-term exam: 20% Final: 50%	Midterm Exam (20%): an exam that may include both practical and theoretical exercises aimed at understanding the concepts of the course related to Topic 1 (Introduction to Algorithm Development), Topic 2 (Algorithm Design Strategies), Topic 3 (Complexity Analysis), Topic 4 (Algorithms and Data Structures), and, if time permits, part of Topic 5 (Sorting Algorithms). Final Exam (50%): an exam that may include both practical and theoretical exercises covering the material from the midterm exam, expanded to include the rest of the course material. NO AI: The assessment must be completed entirely without AI assistance in a controlled environment, ensuring that students rely solely on their existing knowledge, understanding, and skills. You must not use AI at any point during the assessment. You must demonstrate your basic skills and knowledge. Any student who uses AI will receive a Fail (0) for the corresponding exam, and disciplinary proceedings will be initiated in accordance with the University's General Regulations.	70 %



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Individual or Group Assignment/Project/Case Study (15%)	Individual or Group Assignment/Project/Case Study (15%): project encompassing the use of data structures and problem-solving techniques explored in class. In addition to functionality, the design used in the project and the application of the course content will also be assessed. AI COLLABORATION (free URLs only): AI may be used to help complete the task, including idea generation, writing, feedback, and assessment. Students must critically evaluate and modify the results suggested by AI, demonstrating their understanding. You may use AI to perform specific tasks, such as drafting texts and refining and evaluating your work. You must critically evaluate and modify any AI-generated content that you use. In all cases, content generated with the assistance of AI must be critically evaluated by the student. The final result must, at all times, be the student's own work. The inappropriate use of AI tools may affect the overall assessment of the submitted work. Furthermore, the teaching staff reserve the right to question and assess students on specific aspects of their work in order to verify their understanding; the outcome of these consultations may also affect the overall assessment of the corresponding work. Students must clearly document in their submissions the specific tasks for which they have used AI tools. This does not exempt students from responsibility for the submitted content or from the possibility of being questioned about it.	15 %
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Practical Laboratory Work and Practical Sessions Involving the Use of Software (15%)	Practical Laboratory Work and Practical Sessions Involving the Use of Software (15%): practical assignments involving exercises in which students will apply the knowledge acquired in theory classes to the resolution of practical problems. In addition to functionality and the results obtained, the coding style used in the practical assignments (presentation and structure) and the quality of any requested reports (if applicable) will also be assessed. AI COLLABORATION (free URLs only): AI may be used to help complete the task, including idea generation, writing, feedback, and assessment. Students must critically evaluate and modify the results suggested by AI, demonstrating their understanding. You may use AI to perform specific tasks, such as drafting texts and refining and evaluating your work. You must critically evaluate and modify any AI-generated content that you use. In all cases, content generated with the assistance of AI must be critically evaluated by the student. The final result must, at all times, be the student's own work. The inappropriate use of AI tools may affect the overall assessment of the submitted work. Furthermore, the teaching staff reserve the right to question and assess students on specific aspects of their work in order to verify their understanding; the outcome of these consultations may also affect the overall assessment of the corresponding work. Students must clearly document in their submissions the specific tasks for which they have used AI tools. This does not exempt students from responsibility for the submitted content or from the possibility of being questioned about it.	15 %
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Grading

Course Grade

The grade in the academic course will be calculated as follows:

- 50% for the final examination (EX_F)
- 20% for the midterm examination (INTER)
- 15% for the project (PROY)



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- 15% for the practical assignments (PRACT)

The final grade for both the ordinary and extraordinary examination periods will be:

$$\text{FINAL_GRADE} = 0.15 \times \text{PRACT} + 0.15 \times \text{PROY} + \text{MAX}(0.7 \times \text{EX_F}, 0.2 \times \text{INTER} + 0.5 \times \text{EX_F})$$

In other words, the maximum will be selected between considering only the final examination (70% of the grade) and combining 20% of the midterm examination with 50% of the final examination. The grade obtained in the midterm examination will be retained for the extraordinary examination period of the same academic year. To pass the course in either examination period, all the following conditions must be met simultaneously:

- **FINAL_GRADE ≥ 5**
- **EX_F ≥ 5 .** If EX_F is ≥ 5 in the ordinary examination period, the final examination grade will be retained for the extraordinary examination period. Otherwise, the student must retake the examination during the extraordinary examination period.
- **PRACT ≥ 5 .** If PRACT is ≥ 5 in the ordinary examination period, the practical assignment grade will be retained for the extraordinary examination period. Otherwise, the teaching staff will determine the activities required to make up the practical assignments, which may consist of repeating practical assignments, completing new activities, or a combination of both.
- **PROY ≥ 5 .** If PROY is ≥ 5 in the ordinary examination period, the project grade will be retained for the extraordinary examination period. Otherwise, the student must complete the project recovery activity determined by the teaching staff.

If any of these requirements is not met, the final grade for the examination period being assessed will be the lowest of the grades obtained in the final examination (EX_F), the practical assignments (PRACT), or the project (PROY).

WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Reading and studying the theoretical content, notes, and code provided by the instructor.	Before and after each class	
Topic 1: Introduction to algorithm development	At the beginning of the course (January)	1 week approximately
Topic 2: Algorithm design strategies	After topic 1	1 week approximately
Topic 3: Complexity analysis (algorithmic complexity)	After topic 2	1 week approximately
Topic 4: Algorithms and data structures	After topic 3	2 weeks approximately
Topic 5: Sorting algorithms	After topic 4	2 weeks approximately
Topic 6: Search algorithms and heaps	After topic 5	3 weeks approximately
Topic 7: Advanced strategies and algorithms	After topic 6	2 weeks approximately



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Final project	Approximately 1 month before the end of classes	Previous to final exams
Exams	March, May, and June	
Lab assignments	Before, during and after lab classes	After it is published on Moodle (to be determined by the professors)

BIBLIOGRAPHY AND RESOURCES

Basic References
Notes and exercises provided by professors