



GENERAL INFORMATION

Data of the subject	
Subject name	Algorithms and Data Structures
Subject code	DTC-IMAT-120
Main program	Bachelor's Degree in Mathematical Engineering and Artificial Intelligence
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 Sciences

Teacher Information	
Teacher	
Name	Pablo Sánchez Pérez
Department	Department of Telematics and Computer Sciences
E-Mail	psperez@icai.comillas.edu
Teacher	
Name	Roberto Gesteira Miñarro
Department	Department of Telematics and Computer Sciences
E-Mail	rgesteira@comillas.edu
Teacher	
Name	José Villalobos Pérez
Department	Department of Telematics and Computer Sciences
E-Mail	jvperez@comillas.edu

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
- Backtracking

Topic 3: Complexity analysis (algorithmic complexity)

- Efficiency
- Asymptotic notation
- Analysis and complexity classes

Topic 4: Data structures

- Introduction to data structures
- Arrays, lists, tuples
- Stacks, queues, linked lists, and doubly 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
- Graphs and dynamic programming
- Tabulation and memoization techniques

EVALUATION AND CRITERIA



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus 2025 - 2026

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
MidTerm exam: 20% Final exam: 50%	Midterm Exam (20%): An exam focused on applying concepts to solve practical problems. The content will include problem-solving strategies covered in class, complexity analysis, data structures, and, if time permits, some sorting algorithms. Final Exam (50%): An exam covering the remaining course content, where students will be assessed on their ability to apply all the concepts learned in class to problem-solving. NO AI: The assessment is 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 core skills and knowledge. Any student who uses it will receive a Fail (0) on that test and a disciplinary procedure will be initiated in accordance with the University's General Regulations.	70 %
	Weekly Assignments (15%) These assignments will present exercises for students to apply the knowledge acquired in theory classes to solve practical problems. In addition to functionality and results, the evaluation will also consider the coding style used in the assignments (presentation and structure) and the quality of any required reports (if applicable). AI COLLABORATION (only free URLs)	



Laboratory Work and Practical Sessions Using Software (15%)	AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding. You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use. Inappropriate use of AI tools may affect the overall evaluation of submitted assignments. Likewise, faculty members reserve the right to question students about specific aspects of their work to verify their understanding; the outcome of these consultations may also influence the final evaluation of the corresponding assignments. Students must clearly document in their submissions the specific tasks for which they have used AI tools. This does not exempt the student from responsibility for the submitted content, nor from the possibility of being questioned about it.	15 %
Individual or Group Project/Case Study (15%)	Final Project (15%) A project that will involve the use of data structures and problem-solving techniques covered in class. The evaluation will consider not only functionality, but also the design of the project and how well the course content is applied. AI COLLABORATION (only free URLs) AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding. You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use. Inappropriate use of AI tools may affect the overall evaluation of submitted assignments. Likewise, faculty members reserve the right to question students about specific aspects of their work to verify their understanding; the outcome of these	15 %



consultations may also influence the final evaluation of the corresponding assignments.

Students must clearly document in their submissions the specific tasks for which they have used AI tools. This does not exempt the student from responsibility for the submitted content, nor from the possibility of being questioned about it.

Grading

Ordinary Call

Ordinary Call (OC) Grading Criteria

- **50%** Final exam of the course (**EX_F**)
- **20%** Midterm exam (**EX_I**)
- **15%** Project (**PROY**)
- **15%** Weekly assignments (**PRACT**)

In other words:

$$OC = 0.5 \times EX_F + 0.2 \times EX_I + 0.15 \times PROY + 0.15 \times PRACT$$

To pass the course, the following conditions must be met:

1. **OC ≥ 5** (on a scale of 0 to 10)
2. **EX_F ≥ 5**
 - If this condition is not met, then **OC = EX_F**
3. **(PROY + PRACT) / 2 ≥ 5**
 - If this average is not reached in the ordinary call, students may resubmit both the project and the assignments in the extraordinary call. In that case, **OC = (PROY + PRACT) / 2**.
 - The final exam grade from the ordinary call will be carried over to the extraordinary call if it is passed.
4. **PROY ≥ 4 and PRACT ≥ 4**
 - If this condition is not met, then **OC = MIN(PRACT, PROY)**. The grade for the exam in the ordinary call is saved for the extraordinary call if the student passes.
 - If both conditions are met, the grades for PROY and PRACT will be carried over to the extraordinary call, provided that **(PROY + PRACT) / 2 ≥ 5** . If the condition of PROY ≥ 4 and PRACT ≥ 4 is not met, the project and/or the assignments can be handed in again in the extraordinary call.

GENERAL CONSIDERATIONS:

- If the student fails to attend 15% or more of the classroom hours of this subject, the student will not be allowed to take the final exam in both the ordinary and extraordinary calls.
- The lab assignments/project handed in 24h after the deadline will have a penalty of 50% of the grade. After 24h after the deadline, the grade of the lab assignments/project will be 0.

Extraordinary Call

Extraordinary Call (EC) Grading Criteria



- **70%** Final exam of the course (**EX_F**)
- **15%** Project (**PROY**)
- **15%** Weekly assignments (**PRACT**)

In other words:

$$EC = 0.7 \times EX_F + 0.15 \times PROY + 0.15 \times PRACT$$

To pass the course, the following conditions must be met:

1. **EC** $\geq$ **5** (on a scale of 0 to 10)
2. **EX_F** $\geq$ **5**
 - If this condition is not met, then **EC** = **EX_F**
3. **(PROY + PRACT) / 2** $\geq$ **5**
 - If this average is not reached, then **EC** = **(PROY + PRACT) / 2**
4. **PROY** $\geq$ **4** and **PRACT** $\geq$ **4**
 - If this condition is not met, then **EC** = **MIN(PRACT, PROY)**

GENERAL CONSIDERATIONS:

- If the student fails to attend 15% or more of the classroom hours of this subject, the student will not be allowed to take the final exam in both the ordinary and extraordinary calls.
- The lab assignments/project handed in 24h after the deadline will have a penalty of 50% of the grade. After 24h after the deadline, the grade of the lab assignments/project will be 0.

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: Data structures	After topic 3	2 weeks approximately
Topic 5: Sorting algorithms	After topic 4	2 weeks approximately
Topic 6: Search algorithms	After topic 5	3 weeks approximately



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

Syllabus 2025 - 2026

Topic 7: Advanced strategies and algorithms	After topic 6	2 weeks approximately
Final project	Before easter holidays	Previous to final exams
Exams	March, May, and June	
Weekly assignments	Before, during and after lab classes	1 week approximately after its publication in moodle.

BIBLIOGRAPHY AND RESOURCES

Basic References

Notes and exercises provided by professors

In compliance with current regulations on the **protection of personal data**, we would like to inform you that you may consult the aspects related to privacy and data [that you have accepted on your registration form](#) by entering this website and clicking on "download"

<https://servicios.upcomillas.es/sedeelectronica/inicio.aspx?csv=02E4557CAA66F4A81663AD10CED66792>