COURSE DATA

DATA SUBJECT

Code: 36483
Name: Algorithms and data structures
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1407 - Degree in Multimedia Engineering	Escola Tècnica Superior d'Enginyeria	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1407 - Degree in Multimedia Engineering	Estructuras de Datos y Algoritmos	COMPULSORY

COORDINATION

ALBERT BLANCO JESUS V

SUMMARY

The subject \"Data Structures and Algorithms\" is a compulsory subject of the second year of the Degree in Multimedia Engineering. This subject deepens in the knowledge and skills provided by the courses of the basic subject \"Computer Science\" (\"34831 Informatics\" and \"34852 Programming\"), taught in the first year. The subject provides a more grounded and advanced view of programming, improving the student's ability to analyze the cost of algorithms, in the development of more complex algorithms and expanding the catalog of data types seen in the first year, especially with non-linear data types.

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PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is very convenient that students have taken and passed the courses 34831 Informatics and 34852 Programming, of the first year of the Degree in Multimedia Engineering.

The previous knowledge and skills required in this subject are the following:
- Algorithm analysis (better and worse cases).
- Object oriented programming in C ++.
- Programming with linear data structures (stacks, queues, lists).

COMPETENCES / LEARNING OUTCOMES

1407 - Degree in Multimedia Engineering

G6 - Know the basic subject areas and technologies that serve as a basis to learn and develop new methods and technologies and those that provide versatility to adapt to new situations.

I1- Know and be able to apply basic computer algorithmic procedures to design solutions to problems, by analysing the suitability and complexity of the proposed algorithms.

I2 - Know, design and make an efficient use of the data types and data structures that are most suited to solving a problem.

MM28 - Be able to solve problems with initiative, decision-making and creativity and to communicate and transmit the knowledge, abilities and skills of a multimedia engineer.

DESCRIPTION OF CONTENTS

1. Algorithm specification

1.1 Introduction.
1.2 States, asserts.
1.3 Pre/Post specification (Hoare triplet).
1.4 ADT specification (Abstract Data Type).

2. Algorithm efficiency

2.1 Complexity measure
2.2 Cases analysis: better, worse and average cases.
2.3 Asymptotic notation: O, o and omega notation.

3. Recursive algorithm design

3.1 Recursive design.
3.2 Mathematical Induction and recursion.
3.3 Temporal complexity. Recurrence resolution. Characteristic equation.
3.4 "Divide and conquer" paradigm. Quick sort algorithms review.

4. Advanced data types I: Trees

4.1 Foundations.
4.2 Binary trees. Representation.
4.3 Binary trees traversal.
4.4 Special binary trees: search binary trees and heaps.
4.5. k-degree-Trees.

5. Advanced data types II: Tables (maps or dictionaries)

5.1 Foundations.
5.2 Representation.
5.3 Representation using C++/STL.
5.4 Applications.

6. Advanced data types III: Graphs

6.1 Foundations.
6.2 Representation.
6.3 Graph traversal.

7. Greedy algorithms

7.1 General outline.
7.2 Minimum spanning tree. Prim algorithm.
7.3 Minimum path problem. Dijkstra algorithm.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	20,00
Preparation of lessons	45,00

Preparation for assessment activities	15,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

Theoretical classroom activities will develop themes of the subject by providing a global view and integrating, analysing the key aspects in detail and greater complexity, encouraging the participation of the student body at all times. These activities are complemented with practical activities in order to apply the basic concepts, extend them with the knowledge, and experience which will be acquired during the implementation of the proposed work. They include the following kinds of classroom activities:

-Classes of problems and issues in classroom.

-Session for discussion and resolution of problems and exercises previously worked for the students.

-Laboratory practice.

-Realization of individual questionnaires for evaluation in the classroom with the presence of the teacher.

In addition to classroom activities, students must perform personal tasks (out of the classroom) on: targeted bibliographic search, issues and problems, as well as the preparation of lessons and tests. These tasks will be carried out primarily on an individual basis, in order to promote self-employment, but in addition will include jobs that require the participation of small groups of students (2-4) for capacity-building for integration into working groups.

It will use the e-learning platform (Virtual Classroom) from the University of Valencia as a medium of communication with the students. Through it have access to the materials used in class, as well as problems and exercises to solve.

EVALUATION

The subject will be evaluated applying the following three criteria:

1) Criterion 1 (C1): Individual objective tests. Various written tests will be carried out throughout the theoretical-practical course (evaluation of skills CB02, CB04, CG01, CG06, CT03, CT05, CE02, CE06). There will be two types of tests with the following weight:

C1a (70%): Exam of the subject at the end of teaching.

C1b (30%): Intermediate controls carried out during the teaching period.

2) Criterion 2 (C2): Evaluation of the practical activities carried out both in the laboratories and in practical written exercises (evaluation of competences CB02, CB04, CG01, CG06, CT03, CT05, CE02, CE06). These tests will be carried out in groups of (maximum) 2 people and include the following activities:

C2a (70%): Evaluation of laboratory practices.

C2b (30%): Completion of practical written exercises in intermediate controls carried out during the teaching period.

3) Criterion 3 (C3): Continuous evaluation of each student, based on the participation and degree of involvement of the student in the teaching-learning process. The following aspects will be considered (evaluation of competences CB02, CB04, CG01, CT03): Resolution of exercises proposed during the teaching period; Public resolution of issues and problems discussed in class; Participation in the proposed activities.

The final grade for the subject will be calculated as the weighted average of sections C1 (70%) and C2 (30%). Criterion C3 will be considered an extra score of up to 10% over the previous grade, but only if it is greater than or equal to 4.5.

Particular considerations about the evaluation:

1) Non-recoverable sections: The criteria that evaluate the follow-up of the subject during the school period are not recoverable later. These are: C1b, C2b and C3. Criterion C2a (laboratory practices) will be recoverable, only in the 2nd call, through an individual practical exam carried out in the laboratory under conditions equivalent to those of a laboratory practice, but with a limitation of time and access to support materials.

2) Sections that require a minimum grade: To pass the subject, it is required to obtain a minimum grade of 3,5 (out of 10) in sections C1a and C2a.

3) Those students who have completed all the periodical exams of the subject (C1b, C2b) and whose weighted average score in these controls (C1b (70%), C2b (30%)) is greater than or equal to 5 will be exempted from the C1a test (final exam). Additionally, it will be necessary to have obtained a grade greater than or equal to 3 in both C1b and C2b. In these cases, the grade for section C1a will be assigned the weighted average score of the periodic intermediate controls (C1b (70%), C2b (30%)).

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

In any case, the evaluation of the subject will be done in accordance with the Regulations for evaluation and qualification of the University of Valencia for bachelor's and master's degrees approved by the Governing Council on May 30, 2017 (ACGUV 108/2017).

REFERENCES

- F. Ferri, J. Albert, G. Martín, Introducció a l' anàlisi i disseny d' algorismes, Universitat de Valencia, 1999.
- L.R. Nyhoff, TADs Estructuras de datos y resolución de problemas con C++, Prentice Hall, 2ª Ed., 2005.
- M.A. Weiss, Data Structures and Algorithm Analysis in C++, 4ª Ed., Pearson (Addison-Wesley), 2014 https://www.dawsonera.com/abstract/9780273775386
- R. Peña, Diseño de programas. Formalismo y abstracción, Prentice-Hall, 3ª Ed., 2005.