UNIVERSIDADE LUSÍADA
LISBOA

Course Unit Program
Algorithms and Data Structures

Academic Year 2024/2025

1. Organic Unit

Faculty of Business and Economic Sciences

2. Course

Computer Engineering

3. Cycle

1st

4. Course Unit

Algorithms and Data Structures (L9014)

5. Scientific Area

6. Curricular Year

2nd

7. Type of Curricular Unit / Semester

1st Semester

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8. Class type and workload (work time)

Theoretical classes:	
Practical classes:	
Theoretical-Practical Classes	30,00
Tutorial Guidance:	20,00

9. ECTS Credits

6,00

10. Scientific Area Coordinator

11. Regent

Prof. Doutor JOÃO JOSÉ AMARO AMADOR LEITÃO

12. Assistants

13. Teaching Language

Portuguese

14. General Objectives

Give students knowledge in the area of data structures and algorithms. Introduction of more complex and advanced concepts of data structures and algorithms.

15. Specific Objectives

The objectives of this curricular unit are:
- acquire knowledge about algorithms, in particular recursive, sorting and search algorithms, and algorithm complexity analysis;
- acquire the fundamental concepts of the main types of sequential data structures (lists, stacks and queues) as well as non-sequential ones (trees, graphs and hash tables), and the algorithms to handle each structure.

16. Skills to be acquired

At the end of the Curricular Unit, the student should be able to
- to develop algorithmic skills, particularly in problems involving recursion, sorting and/or searching, being able to analyze the complexity associated with these algorithms in order to discern the most efficient way to solve the problem in question;
- devise, outline and implement data structures and respective algorithms with a view to solving problems.

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17. Teaching Methodology

Presentation of theoretical material followed by analysis and commentary of significant examples. Presentation of the weekly exercises to be carried out autonomously by the students in addition to the classes. Monitoring the autonomous resolution of weekly assignments, and their subsequent correction.

18. Course Unit Program

1. Fundamentals
1.1. Variables, expressions, logic
1.2. selection, repetition
1.3. Subprograms, data types

2. Dynamic memory allocation
2.1. Allocation Functions
2.2. sharpeners

3. Recursive Algorithms

4. Sorting Algorithms
4.1. Iteratives: Selection and Exchange (Bubblesort)
4.2. recursive: by merge (merge sort), by separation (quicksort)

5. Search algorithms
5.1. Iterative: exhaustive, sequential and binary;
5.2. Recursives: Binary

6. Hash tables

7. Algorithm complexity analysis

8. Sequential Data Structures
8.1. Simply and doubly linked lists
8.2. Stacks
8.3. queues
8.4. jump lists

9. Non-Sequential Data Structures
9.1. Binary, search, heap trees
9.2. Directed, undirected graphs
9.3. Hash tables

19. Assessment Methods

The continuous assessment methodology is expressed in the Regulamento Geral de Avaliação Contínua in force.

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20. Didactic Resources

Classes will be given using visual presentations and joint resolution of exercises. Class materials will be made available to students, with solved examples. Work will be made available to solve individually, whose resolution will be monitored and which will be later corrected and resolved in class.

We use C/C++ for the exercises, preferably with CLion (https://www.jetbrains.com/clion/)

21. Sustainability Objectives

4. Quality Education
5. Gender Equality
9. Industry, Innovation and Infrastructure

22. Keywords

Data structure
Algorithms
recursive
ordination
search
hash table
complexity

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23. Main Bibliography

Author(s):	Teema Thareja		
Title:	Data Structures Using C		
Edition:	2nd	Year:	2018
Local:	USA		
Publisher:	Oxford University Press		

Author(s):	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein		
Title:	Introduction to Algorithms		
Edition:	3ª	Year:	2009
Local:	USA		
Publisher:	The MIT Press		

Author(s):	Richard E. Neapolitan		
Title:	Foundations on Algorithms		
Edition:	5th	Year:	2015
Local:	London		
Publisher:	Jones & Bartlett Learning		

24. Complementary Bibliography

Author(s):	António Adrego da Rocha		
Title:	Estruturas de Dados e Algoritmos em C		
Edition:	1ª	Year:	2008
Local:	Lisboa		
Publisher:	FCA-Editora de Informática		

Author(s):	Kurt Mehlhorn, Peter Sanders		
Title:	Algorithms and Data Structures: The Basic Toolbox		
Edition:	1ª	Year:	2008
Local:	USA		
Publisher:	Springer		

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Ficha técnica MIP / MIP Datasheet	
Título / Title	Course Unit Program 'ALGORITMOS E ESTRUTURAS DE DADOS': Academic Year 2024/2025
Autor / Author	Prof. Doutor JOÃO JOSÉ AMARO AMADOR LEITÃO
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Colaborador(es) / Colaborator(s)	-
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