| Course Unit | Programming Languages III |  |  |  |  | Field of study | Computer Science |  |  |  |  |  |  |
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| Bachelor in | Informatics and Communications |  |  |  |  | School | School of Public Management, Communication and Tourism |  |  |  |  |  |  |
| Academic Year | 2023/2024 | Year of study | 2 |  |  | Level | 1-2 |  | ECTS credits |  | 6.0 |  |  |
| Type | Semestral | Semester | 1 |  |  | Code | 9188-320-2105-00-23 |  |  |  |  |  |  |
| Workload (hours) | 162 | Contact hours | T | 15 | TP | 45 | TC | S | E | OT 20 |  | 0 |  |
|  |  |  | T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E-Placement; OT - Tutorial; O-Other |  |  |  |  |  |  |  |  |  |  |
| Name(s) of lecturer(s) | António José Gonçalves Mourão |  |  |  |  |  |  |  |  |  |  |  |  |

## Learning outcomes and competences

At the end of the course unit the learner is expected to be able to

1. Describe typical applications for each one of the studied Data Structures;
2. Develop programs of average complexity that use the studied Data Structures;
3. Choose the more appropriated Data Structure to solve problems, understanding that other factors exist that influence in the choice, such as: time, space and problem complexity
4. Acquire, with self-effort, knowledge on not studied Data Structures.

## Prerequisites

Before the course unit the learner is expected to be able to

1. Have advanced knowledge of programming languages;
2. Have some Easiness on understanding mathematical notations.

## Course contents (extended version)

1. Algorithm Notion and Data Structures, Data Structures $x$ algorithmic Efficiency.
2. Algorithms Analysis:

Space and time complexity, Big O Notation

- Asymptotic algorithms analysis, Identify differences between best, worse and average case.

3. Arrays search Algorithms:

- Linear and Binary search;
- Asymptotic analysis: space and time complexity

4. Sorting Algorithms:

- InsertSort, SelectionSort, Bubble Sort, QuickSort, Merge Sort, Heap Sort

Asymptotic analysis: space and time complexity.
5. Linear Data Structures:

Simple linked lists, Doubly linked lists, Circular linked lists, Stacks, Queues, Hash Tables;

- Asymptotic analysis: space and time complexity.

6. Non Linear Data Structures:

- Generic trees, Binary trees, Binary search trees, Graphs;

Asymptotic analysis: space and time complexity.

## Recommended reading

1. Esakov, J. \& Weiss, T. (1998). Data Structures, An Advanced Approach Using C". Prentice Hall International Editions. ISBN: 0131988476
2. Matos, P. (2006). IPB-Estruturas de Dados. Bragança
3. Petzold, C. (2013). NET Book Zero - What the C or C++ Programmer Needs to Know About C\# and the . NET Framework. Acedido em 16/09/2019 em http: //www charlespetzold. com/dotnet/index html
4. Preiss. B. R. (2013). Data Structures and Algorithms with Object-Oriented Design Patterns in C\#
5. Rocha, A. (2014). Estruturas de Dados e Algoritmos em C. FCA. 3ª edição ISBN: 978-972-722-769-3

## Teaching and learning methods

Problems presentation and solutions finding followed by some problem resolution implementation (in classroom and home), in which is intended to consolidate the argued theoretical concepts.

## Assessment methods

- Final Evaluation - (Regular, Student Worker) (Final, Supplementary, Special)
- Laboratory Work - 10\% (Optional. Weekly Challenges to sove as homework)
- Practical Work - $40 \%$ (Mandatory. Minimum grade: 7 points)
- Final Written Exam - $50 \%$ (Mandatory. $60 \%$ if the classification is higher than the classification of Laboratory Work)


## Language of instruction

Portuguese, with additional English support for foreign students.
Electronic validation

| António José Gonçalves Mourão | Vítor José Domingues Mendonça | Anabela Neves Alves de Pinho | Luisa Margarida Barata Lopes |
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| $15-10-2023$ | $19-10-2023$ | $19-10-2023$ | $20-10-2023$ |

