Course Unit	Programming Languages III			Field of study	Computer Science	
Bachelor in	Informatics and Communications			School	School of Public Management, Communication and Tourism	
Academic Year	2022/2023	Year of study	2	Level	1-2	ECTS credits 6.0
Type	Semestral	Semester	1	Code	9188-320-2105-00-22	

Workload (hours)	162	Contact hours	T	15	TP	-	PL	45	TC	-	S	-	E	-	OT	20	O	-

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

An Introdution to Algorithm Analysis: time complexity and space complexity; Data Structures: Linked structures, Implementation strategies for stacks, queues, and hash tables; Implementation strategies for graphs and trees; Strategies for choosing the right data structure; Computing algorithms: Sequential and binary search algorithms, Sorting algorithms, Hash tables, Binary search trees, Graph Representations.

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

1. Distributed Evaluation (and incomming students) - (Regular, Student Worker) (Final, Supplementary)
   - Laboratory Work - 10%
   - Practical Work - 40% (Minimum grade: 7 points)
   - Final Written Exam - 50% (60% if the classification of this component is higher than the classification of Laboratory Work)
2. Distributed Evaluation (and incomming students) - (Regular, Student Worker) (Special)
   - Practical Work - 40% (Minimum grade: 7 points)
   - Final Written Exam - 60% (Minimum grade: 7 points)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation			
António José Gonçalves Mourão	Vítor José Domingues Mendonça	Elisabete da Anunciacao Paulo Morais	Luisa Margarida Barata Lopes
30-09-2022	09-10-2022	10-10-2022	10-10-2022