Course Unit	Discrete Mathematics			Field of study	Mathematics		
Bachelor in	Management Informatics			School	School of Technology and Management		
Academic Year	2022/2023	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9186-709-1203-00-22		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	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): Paula Maria Pereira de Barros

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Mastering the basics of logic, logical operations and their properties.
2. Operate with sets and evaluate relationships and entire functions and their properties.
3. Proving propositions and algorithms using the method of finite induction.
4. Use the Euclidean algorithm for calculating the greatest common divisor of two numbers and for solving Diophantine equations.
5. Solve counting problems by applying the combinatorial calculus and binomial and multinomial theorems.
6. Evaluate, in a graph: order, paths and circuits, isomorphism, planarity, chromatic number. Apply the algorithms of Prim, Kruskal and Dijkstra.

Prerequisites

Before the course unit the learner is expected to be able to:
Be confortable with the mathematical concepts and skills taught in high school.

Course contents

Logics. Set Theory and Number Theory. Elementary Principles of Counting. Induction and Recursion. Introduction to Graph Theory.

Course contents (extended version)

1. Logics.
   - Propositional Logics, logical implication, inference rules, valid and invalid arguments.
   - Predicate logics, quantifiers.
2. Set Theory. Number Theory.
   - Sets and subsets, operations on sets, laws of set theory.
   - Relations and discrete functions.
   - Prime numbers, Euclidean theorem and the Fundamental Theorem of Arithmetic.
   - Mathematical induction.
3. Elementary Principles of Counting.
   - Permutations and combinations of a set of elements. Multinomial theorem.
   - The pigeonhole principle.
   - Lexicographical ordering of combinations and permutations.
4. Graph Theory.
   - Graph isomorphism, planar graphs, graph coloring, Euler and Hamilton paths and circuits.
   - Trees, n-ary trees, depth-first and depth-first search algorithms.
   - Minimal spanning tree, Kruskal and Prim algorithms, Dijkstra algorithm. Applications.

Recommended reading

1. Goodaire, E. G. , & Parmenter, M. M. (1998). Discrete Mathematics with Graph Theory. Prentice Hall.
2. Oliveira, C. , & Magalhães, F. (2004). Introdução à Análise Combinatória. Escolar Editora.
3. Silva, J. S. (1975). Compêndio de Matemática. Lisboa: Gabinete de Estudos e Planeamento do Ministério de Educação e Cultura.
4. Stein, W. (2011). Elementary Number theory: primes, congruences, and secrets. Springer.
5. Wilson, R. J. (1999). Introduction to Graph Theory. Longman.

Teaching and learning methods

Topics will be presented and explored in class. There will be individual and group sessions outside class to accompany the student's work.

Assessment methods

1. Distributed evaluation 1 - (Regular, Student Worker) (Final, Supplementary)
   - Intermediate Written Test - 40%
   - Intermediate Written Test - 10% (Class question.)
   - Intermediate Written Test - 30%
   - Practical Work - 20% (Work carried out throughout the semester.)
2. Distributed evaluation 2 - (Regular, Student Worker) (Final, Supplementary)
   - Intermediate Written Test - 50%
   - Intermediate Written Test - 50%
3. Concentrated evaluation - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100% (The written exam may be complemented with an oral test to defend the grade.)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Paula Maria Pereira de Barros	Florbela Alexandra Pires Fernandes	José Carlos Rufino Amaro	Nuno Adriano Baptista Ribeiro
08-03-2023	15-03-2023	17-03-2023	27-03-2023