

LOGISTICS, SUPPLY CHAIN & MARITIME BUSINESS

35007 - MATHEMATICAL MODELLING IN LOGISTICS

General information

- Academic year 2023/24
- Course: First
- Trimester: Second
- Number of credits: 3
- Teachers:
 - Rosa Herrero Antón [<rherrero@tecnocampus.cat>](mailto:rherrero@tecnocampus.cat)

Teaching languages

- Spanish

Classes are taught in Spanish, but some materials may be in English.

Presentation of the subject

This subject introduces students to mathematical modeling to solve logistical problems with uncertainty and risk.

Competences/learning outcomes

Basic

- CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context
- CB7 How to apply the knowledge acquired and the ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to the area of study.

Specific

- CE2. Application of tools and methodologies that facilitate creative and innovative thinking in everyday situations linked in the supply chain environment, logistics, and maritime businesses.
- CE4. Strategically manage the processes of business innovation in the supply chain and the maritime business, from the diagnosis to its application, being able to align resources, abilities and abilities to put them into practice
- CE7. Manage (plan, program and control) the flow of materials and information (flow of the supply chain) through the direction and coordinated management of the areas of purchases, production and physical distribution of the company.

Transversal

- CT1. Show willingness to learn about new cultures, experience new methodologies and foster international exchange in the context of logistics, the supply chain and maritime businesses.
- CT2. Show entrepreneurial leadership and management skills that strengthen personal confidence and reduce risk aversion.
- CT3. Develop tasks by applying the acquired knowledge with flexibility and creativity and adapting them to new contexts and situations.

No data

Contents

1. Introduction

- 1.1 Concept of mathematical model
- 1.2 Types of systems
- 1.3 Methodologies and algorithms

2. Graph theory

- 2.1 Definition, representation and topology
- 2.2 Application examples
- 2.3 Matrix associated with a graph and graph isomorphism
- 2.4 Algorithms in graphs
 - 2.4.1 Minimum spanning tree and Prim vs Kruskal algorithms
 - 2.4.2 Shortest path and Dijkstra's algorithm
 - 2.4.3 Flow problem in a network and the Ford-Fulkerson algorithm

3. Stochastic processes

- 3.1 Definition of stochastic processes and random variables
- 3.2 Examples and special cases
- 3.3 Markov chain in discrete time
- 3.4 Markov chain in continuous time

4. Travelling Salesman Problem

- 4.1 Problem definition
- 4.2 Its variants
- 4.3 Methodologies

5. Vehicle Routing Problem

- 5.1 Problem definition
- 5.2 Its variants
- 5.3 Methodologies

6. Nonlinear Programming

- 6.1 Definition and qualification of non-linearity
- 6.2 Examples
- 6.3 Special case: problems with linear restrictions
- 6.4 Karush-Kuhn-Tucker conditions and interpretation of Lagrange multipliers
- 6.5 Methodologies

Sustainable Development Goals

- 04 - Quality education
- 09 - Industry, innovation and infrastructure

Evaluation system

In order to collect evidence of the achievement of the expected learning results, the following evaluative activities will be carried out.

10% Graph Theory: exercises to be solved in pairs through the virtual classroom based on the theoretical content.

10% Stochastic Processes: exercises to be solved in pairs through the virtual classroom based on the theoretical content.

15% Salesman Problem: exercises to be solved in pairs through the virtual classroom based on the theoretical content.

15% Vehicle Routes Problem: exercises to be solved in pairs through the virtual classroom based on the theoretical content.

50% Individual final exam: examination of the entire subject content.

Each student's final grade will be calculated following the corresponding percentages.

Considerations:

- You must obtain a grade above 4 in the final exam to pass the subject.
- The teacher will inform the dates and format of the delivery of the exercises. An activity not delivered or delivered late and without justification (court summons or medical matter) counts as a 0.
- It is the student's responsibility to avoid plagiarism in all its forms. In the case of detecting plagiarism, regardless of its scope, in some activity it will correspond to having a grade of 0. In addition, the teacher will communicate the situation so that applicable measures can be taken in terms of disciplinary regime.