

Course Unit: 9152323; 9994323 – Operations Research

Year 2 Semester 4 ISCED Code: 469 ECTS: 5.0

Type of Course Unit: Compulsory **Delivery Mode:** Face-to-face **Language of Instruction:** Portuguese

COURSE COORDINATOR: Maria Teresa de Abreu Luís Godinho

HOURS OF WORK

TOTAL HOURS	Contact Hours								Hours in autonomous work
	Theory	Theory and practice	Practical and laboratory work	Field work	Seminar	Internship	Tutorial guidance	Other	
125		30	30						65

Prerequisites (if applicable): Not applicable

LEARNING OUTCOMES (knowledge, skills and competence)

This course unit prepares undergraduates to model and solve some typical Operations Research problems. The primary emphasis of this course is not on mathematical foundations but on applications, and therefore extensive hands-on exercises using real world data and solved by means of an appropriated solver are included. On successful completion of this course unit, the student should be able to: Model LP and ILP problems; Solve LP and ILP models both by hand and by means of an appropriate solver; Give an economic explanation of the solution; Perform Sensitivity Analysis and Parametric Analysis.

CONTENTS

Linear Programming (LP):

- Linear Programming formulations;
- Linear algebra review, geometry of linear programming;
- Solving a Linear Programming model:
 - Graphical method;
 - Simplex method;
 - Sensitivity analysis and pos -optimization.

Integer Linear Programming (ILP):

- Integer Linear Programming Formulations:
 - Binary Models;
 - Branch and Bound.

Solving LP and ILP using MPL software

DEMONSTRATION OF THE CONTENTS COHERENCE WITH THE COURSE UNIT'S LEARNING OUTCOMES

Operations Research combines a number of methods and techniques, originated from various disciplines, with the aim of developing, analyzing, and validating mathematical models for decision problems and their systematic solution. From this broad spectrum of themes that could have been included in such a UC, we have selected Linear Programming and Integer Linear Programming. Those two topics deal with some very important problems in business applications such as Production Planning, Job Shop, Transports, Assignment, Cover and Partition. By solving some of those problems in class we intend to make the students realize the importance of the use of Operations Research in decision making environment. The remaining goals give some details on the specific topics of LP and ILP to be studied in class.

TEACHING METHODOLOGIES

Theoretical-practical Lectures and computer aided Laboratory Classes.

DEMONSTRATION OF THE COHERENCE BETWEEN THE TEACHING METHODOLOGIES AND THE LEARNING OUTCOMES

As said before, the primary emphasis of this course is on applications. Therefore students are expected to be able to solve extensive hands-on exercises. This kind of exercises usually involves a huge number of variables, making it hard to solve them without computer aid. On the other hand, the use of computer solvers helps to illustrate how Sensitivity Analysis and Parametric Analysis work in practice. In the Theoretical-practical Lectures students are taught the algorithms supporting the solvers used in class.

EVALUATION METHODS

Assessment includes a written test and a group project:

Written test: Points necessary for grade: 8/20

Group project:

The group project is divided into the following steps:

1. Analyzing the problem and collecting the data;
2. Modeling the problem;
3. Writing and testing a computer program using MPL language;
4. Building the users Interface;
5. Writing a written report.

All computer files produced must also be submitted. Points necessary for grade: 10/20 points In order to translate into individual grades the group performance, each team will take an oral examination on the topics listed above).

MAIN BIBLIOGRAPHY

Valadares Tavares, L., Oliveira, R., Themido, I. et al. 1997. *Investigação Operacional*. Lisboa: MacGraw-Hill.

Guéret, C., Prins, C., Sevaux, M. 2002. *Applications of optimization with Xpress-MP*: Dash Optimization Ltd. (Disponível on-line: https://www.researchgate.net/profile/Marc_Sevaux/publication/248591052_Applications_of_optimization_with_Xpress_-_MP/links/00463539b191cdd21c000000.pdf).

Year of implementation: 2019/2020 | Date of approval by the Technical-Scientific Board: 2015-09-01