



Universitat de Lleida

DEGREE CURRICULUM  
**OPERATIVE RESEARCH**

Coordination: PLA ARAGONES, LUIS MIGUEL

Academic year 2021-22

Subject's general information

<b>Subject name</b>	OPERATIVE RESEARCH			
<b>Code</b>	101342			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Business Administration and Management	4	OPTIONAL	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRAULA		TEORIA
	<b>Number of credits</b>	2.7		3.3
	<b>Number of groups</b>	1		1
<b>Coordination</b>	PLA ARAGONES, LUIS MIGUEL			
<b>Department</b>	MATHEMATICS			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Català			
<b>Distribution of credits</b>	Silvia Miquel Fernandez 3 Lluís Miquel Pla Aragones 3			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
PLA ARAGONES, LUIS MIGUEL	lluismiquel.pla@udl.cat	6	

## Subject's extra information

### Suggestions

The subject must work a week (at least 6 hours a week of dedication at home), read the notes available on campus before the corresponding class and solve problems that were proposed during the year.

The course as part of the academic plan

After having completed the 180 credits of compulsory of Business Administration degree, the curriculum provides for certain specialization through electives. Within this optionality is the subject of Operations Research, which is close to the subjects of Mathematics Enterprise (the linear programming) and Operations Management.

## Learning objectives

See competences

## Competences

### University of Lleida strategic competences

- Correctness in oral and written language.

### Goals

- Argues correctly the process involved in planning and problem solving and interprets the results.
- Use correct mathematical language in the approach and solve linear programming problems.

- Master Information and Communication Technologies.

### Goals

- Use the correct tool for a Solver spreadsheet.
- Interpret the results report and the report of sensitivity obtained using the Solver tool of a spreadsheet.
- Find Internet the information necessary to study different models of operations research.

### Degree-specific competences

- Apply instrumental techniques to the analysis and solution of business problems and to the taking of decisions.

### Goals

- Know what is meant by operational research and know the scope.
  - Put linear programming as part of operations research.
  - Formula linear programming problems.
  - Learn about the basic elements of a linear program.
  - To know theoretical basis of the simplex algorithm.
  - Applying the simplex or dual simplex method as appropriate.
  - Learn the expression matrix of a linear program, the advantages of this expression analysis of a solution either.
  - Recognizes the type of solution based on the simplex table.
  - Know consider the dual linear program corresponding to a primal either.
  - Use the optimal dual linear program to obtain information about the optimal primal.
  - Find the solution of linear program without using any artificial variables.
  - Deduces procedures that automate the search for new solutions to a problem that has been slightly modified the initial situation, without having to solve from the beginning.
- Elaborate, interpret and audit the economical-financial information of entities and individuals, and provide them with assessment.

## Goals

- Formulates linear programming problems.
- Interprets tables simplex and recognizes the type of solution of a linear program.
- Interprets the dual solution to a linear program.
- Determine the effect on the optimal solution of a linear program, a small change in the initial conditions for the problem.

## Degree-transversal competences

- Ability to criticise and be self-critical.

## Goals

- Justifies adequately the approach and method of resolution applied.
- Select formulation of the linear program easier and more appropriate in each case.
- Argues on the basis of mathematical concepts to decision-problem a given situation.

- Ability to organise and plan.

## Goals

- Organize your time on the tasks that were entrusted to the subject.

- Teamwork and leadership.

## Goals

- Participate in the planning of teamwork.
- Assume responsibility that derives from the division of tasks of teamwork.
- Participate in the evaluation of the results of teamwork.

- Be able to work and to learn in an autonomous way and simultaneously adequately interact with others, through cooperation and collaboration.

## Goals

- Learn from the mistakes committed while seeking alternative strategies to solve problems.
- Find information about operations research in general and in particular linear programming.
- Raises questions that go beyond the information provided in lectures.
- Relate concepts appearing in different subjects.

- Ability to analyse and synthesise.

## Goals

- Analyze a problem situation, and select the important elements when you want to make a decision.

- Act in accordance with rigour, personal compromise and in a quality orientated way.

## Goals

- Use mathematical language with precision and property, both in planning and in solving problems.
- Justifies the approach and the process of problem solving and interpretation of results.

## Subject contents

### **Unit 1. Linear programming**

Definign the linear program

Characteristics of the linear programs

Intuitive approximation method for solving linear programs

### **Unit 2. The simplex algorithm**

The simplex algorithm

Expression of the matrix simplex agorithm

The dual-simplex algorithm

### **Unit 3. Interpretation of results**

Activation unavariabe secondary decision

Increased the term independent of a contraitm

Special situations: no limited solutions, multiple solutions and nonexistence of solution

### **Unit 4. Analysis of sensitivity**

Changing the objective funtion coefficient

Changing the term independent of a contraitm

Modification of the technical coefficients of restrictions

Adding a contraitm

### **Unit 5. The dual model**

Symetric primal linear program and its dual

Fundamental theorems

Dual of no symetric

### **Unit 6. Operations research models**

The problem of allocating

The transport problem

The problem of transfer

The problem of the shortest path

The problem of the maximun flow

The problem of inventory

## Unit 7. Multi-objective and integer linear programming

Introduction to integer programming

The methods of approach and explicit enumeration

The algorithm brachand bound

Introduction to programation 0-1

Introduction to multi-objective programming. Efficient solutions and best compromise

The ponderations method and the i simplex multi-objective.

The method of weighting and multi-objective simplex

## Methodology

En aquesta secció considerem la metodologia de l'assignatura i fem una taula que en resumeix la temporització.

El semestre consta de 19 setmanes.

En quatre d'aquestes setmanes es duen a terme activitats programades d'avaluació ([calendari d'exàmens](#)).

Durant les altres 15 setmanes, els dimarts i els dimecres (dues hores cada dia) s'imparteixen classes presencials ([horari](#)). En aquestes classes es combina la teoria i la pràctica.

Pels temes 2, 3, 5 i 7 es preveu fer una classe pràctica a l'aula d'informàtica (full de càlcul).

Abans d'assistir a una classe presencial cal consultar l'agenda i els recursos del campus virtual per tal de revisar els materials disponibles que seran objecte de comentari a classe.

Temporització

Setmana	Tema	Hores presencials	Hores treball autònom
1	Tema 1	4	6
2	Tema 2	4	6
3, 4 i 5	Tema 3	12	18
6	Tema 4	4	6
7 i 8	Tema 5	8	12
9	Parcial 1 (dia 13 de novembre de 2013)		
10 i 11	Tema 6	8	12
12, 13 i 14	Tema 7	12	18
15 i 16	Tema 8	8	12
17 i 18	Parcial 2 (dia 30 de gener de 2013)		

## Evaluation

L'avaluació és continuada i, per tant, es té en compte l'activitat d'aprenentatge duta a terme per l'estudiant en el desenvolupament de l'assignatura.

Les evidències d'avaluació i la seva ponderació en el càlcul de la nota final es resumeixen a continuació.

Evidencia	Peso
Presentación periódica de problemas	15%
Parcial 1 (temas del 1 al 3)	25%
Parcial 2 (todo el temario)	25%
Ejercicios en el aula de informática y Kahoots (o similar)	20%
Presentación de un trabajo de simulación	15%

## Bibliography

Recommended bibliography

### Basic Bibliography

Ríos Insua, S. (1996) *Investigación operativa. Programación lineal i aplicaciones*. Ed. CERA.

Arreola , J.S. i Arreola, A. (2003) *Programación lineal. Una introducción a la toma de decisiones cuantitativa*. Ed. Thomson.

Winston, W.L. (2005) *Investigación de operaciones. Aplicaciones y algoritmos*. Ed. Thomson.

### Complementary bibliography

Chiang, A. (1987) *Métodos fundamentales de la economía matemática*. McGraw-Hill.

Gardner, R. (1992) *Juegos para empresarios y economistas*. Antoni Bosch Editor.

Heras et al. (1990) *Programación matemática y modelos económicos: Un enfoque teórico-práctico*. AC.

Rafels, C. et al. (1999) *Jocs cooperatius i aplicacions econòmiques*. Ediciones UB.

Ramos, E. (1995) *Programación lineal y métodos de optimización*. UNED.

Taha, H.A. (1991) *Investigación de operaciones*. Alfaomega.

Villalba, D, i Jerez, M. (1990) *Sistemas de optimización para la planificación y toma de decisiones*. Pirámide.

Winston, W. (1991) *Investigación de operaciones*. Grupo editorial Iberoamérica.