Teaching plan:

Operations Research
(Quantitative methods in Management)

1. Description of the course

- Name of the course: Operations Research (Quantitative methods in management)
- Academic year: 2022-2023
- Quarter: first
- Degrees: ECO, ADE, IBE
- ECTS: 5
- Student hours dedication: 125 hours
- Teaching language: English
- Professor: Daniel Serra (daniel.serra@upf.edu)
- TA: Carolina Castañeda (carolina.castaneda@upf.edu)

  daniel.serra@upf.edu
  Office hours: On demand

2. Course presentation

The area of quantitative methods for decision making uses the scientific method as the basis to research and help make decisions on complex problems of the organizations. The purpose of this course is to equip the participants with the relevant tools and techniques for applications in solving managerial problems. The focus of this course will be on applications of quantitative methods in business situations.

The methodology of the course is based on what is known as Operations Research, a science that offer to the decision maker different quantitative methodologies in order to make decisions. The objective of the course is to learn the fundamental concepts, the quantitative models, up to date solution techniques in problem solving and complex decision making. During the course we will see how to apply these techniques in different areas of an organization, such as marketing, production and operations, logistics, finance, etc. Emphasis will be made on practical and real world applications. Excel spreadsheet together with the module "Solver" will be intensively used.

3. Competences to be achieved

The objective of the course is to provide the fundamental concepts, quantitative models, solution methods and up to date techniques in decision making.

General competences	Specific competences
Instrumentals • Organization and planning capacities. • Knowledge of software. • Problem solving. • Information search and processing Interpersonals • Oral communication in public. • Team work. • capacity to write technical reports. Systematics • Critical reasoning skills in both reading and writing communication. • Good analysis of qualitative and quantitative information. • Adaptation yo new situations and environments.	Academic and professionals • Recognize the relevance of quantitative methods in decision making within management organizations. • To be able to know when these tools can be used, and in which environments, and when not to use them. • To learn how to apply these tools and methodologies of quantitative methods in managerial problems. • To be able to use information system technologies and optimization software as a support for complex decision making situations. • To develop the understanding of the results obtained and how to implement them in “real world” situations

4. Course program

1. Introduction to modelling and decision making

2. Linear Programming:
   - 2.1. Structure of the problem.
   - 2.2. Mathematical conditions.
   - 2.3. Objectives and constraints.
   - 2.4. Examples of formulations: human resources problems, capacity problems, transportation problems.

3. Solution methods in LP
   - 3.1. Graphical method
   - 3.2. The simplex algorithm
   - 3.3. Solver and other software.
   - 3.4. Heuristic methods

4. Multiobjective programming
   - 4.1. Objective space.
   - 4.2. Efficiency in solutions
   - 4.3. The weighting method and constraint methods. Case studies.
   - 4.4. Goal programming.

5. Integer programming
   - 5.1. Problem formulation.
   - 5.2. The branch and bound procedure.
   - 5.3. The knapsack problem.
   - 5.4. Assignment problems.

6. Network Models
   - 6.1. Network notation
   - 6.2. Minimum spanning tree
   - 6.3. Maximal flow
   - 6.4. Shortest Path
   - 6.5. Location problems

7. Project Management
   - 7.1. Critical Path Model
   - 7.2. PERT
   - 7.3. PERT/CMP
   - 7.4. PERT/cost
   - 7.5. Case study

5. Evaluation

- Final exam: 60% of the grade. You need to obtain in this exam at least a grade of 4 out of 10 to pass the course.
- Continuous evaluation: 40% of the grade: homeworks and case studies

- Attendance to seminar sessions and homework submissions are compulsory.

- The retake of the exam counts also 60% of the grade. You need to obtain in this exam at least 4 out of 10 to pass the course.

6. Methodology

The teaching activities during the course will be as follows:

- 7 homeworks. Students will have to submit electronically the homework in groups of maximum 3. The hour to submit the homeworks will be indicated in the schedule of the course. Solutions to the homeworks will be posted each week

7. Schedule

- **In the intranet of the course you will find the weekly schedule**

8. Bibliography

Basic textbook:

- Render, B., Stair, R. & Hanna, M.E. (2016). Quantitative Analysis for Management, 13th edition. Pearson Prentice Hall.

Additional references

- Hillier F., Hillier M. y Lieberman, G.(2008). Introduction to Management Science: A Modeling & Case Studies Approach McGraw Hill.
- Powell, S.G. & Baker, K.R. (2010). The Art of Modelling with Spreadsheets: Management Science and Modelling Craft, 3rd edition, Wiley
- Winston, W. (2004). Excel Data Analysis and Business Modeling, Microsoft Press

Other references

Quantitative Analysis For Management
Charles P. Bonini , Warren Hausman , Harold Bierman
McGraw-Hill/Irwin; 9 edition (January 1, 1997)

Quantitative Methods for Decision Makers (4th Edition)
Mik Wisniewski
Prentice Hall; 4 edition (February 27, 2006)

Quantitative Business Modeling
Jack R. Meredith , Scott M. Shafer , Efraim Turban
South-Western College Pub; 1 edition (October 8, 2001)

An Introduction to Management Science: A Quantitative. Approach to Decision Making
David R. Anderson , Dennis J. Sweeney , Thomas A. Williams , R. Kipp Martin
South-Western College Pub; 12 edition (April 19, 2007)

Spreadsheet Modeling and Decision Analysis
Cliff Ragsdale
South-Western College Pub; 5 edition (May 3, 2006)

Quantitative Techniques
T Lucey
Int. Cengage Business Press; 6 edition (September 12, 2002)

Quantitative Methods: A Short Course
Jon Curwin , Roger Slater
Int. Cengage Business Press; 1 edition (March 4, 2004)

Study Guide to accompany Introduction to Management Science: Quantitative Approaches to Decision Making
David R. Anderson , Dennis J. Sweeney , Thomas A. Williams
South-Western College Pub; 11 edition (March 22, 2004)

Handbook of Metaheuristics
Glover F. & G. A. Kochenberger
Springer New York, 2003

Software

- Excel Spreadsheet

About the instructor

Daniel Serra graduated in 1984 in Economics from the Autonomous University of Barcelona, and obtained a master in systems analysis and his PhD in the Whiting School of Engineering at Johns Hopkins University in 1989. He is actually professor of management in the department of Economics and business at the Universitat Pompeu Fabra (UPF). His fields of specialization are logistics and quantitative methods in management. He has more than 30 publications in international journals, such as European Journal of O.R., Computers and O.R., Journal of the Operational Research Society, Network and Spatial Economics, Journal of Regional Science, Geographical Analysis, Papers in Regional Science, among others. He belongs to the editorial board of Geographical Analysis, International Journal of Regional Science, Supply Chain Practice, and International Journal of Operations Research and Information Systems. He has worked in consulting for several firms and institutions in the implementation of quantitative models for decision making. He has been vicerector of the UPF from 2001 to 2013 and Dean of the UPF Barcelona School of Management (2013-2018). Actually, he is the chairman of the Dept. of Economics and Business at UPF.

Personal webpage: www.danielserra.es