Quantitative Methods in Management

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Objectives
Quantitative decision-making is the use of mathematical methods and data analysis, as the means to analyze and help make educated decisions about complex problems. The main goal of the course is to provide students with the relevant tools and techniques for solving managerial decision problems of a quantitative nature, all taught through practical scenarios and real-world applications. The course makes extensive use of Excel spreadsheets, together with the "Solver" module.

The foundations of the course lie in the field of Operations Research, the science of quantitative decision-making in a managerial context. The objective is to understand the fundamental concepts, quantitative models, and solution techniques of Operations Research. An equally important objective is to see how these techniques are applied in different departments of a firm, e.g., marketing, production and operations, logistics, finance, etc.

Description
“Quantitative Methods in Management” is a second-term course in the MSc in Management, at the Barcelona School of Management. It comprises twenty 90-min lectures, serving as a core course for students specializing in Business Analytics, and as an elective course for students specializing in Marketing and Entrepreneurship.

Contents
1. Introduction to modelling
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. Integer programming
   4.1. Problem formulation.
   4.2. The branch and bound procedure.
   4.3. The knapsack problem.
4.4. Assignment problems.
4.5. Location modelling problems

5. Multi-objective programming
5.1. Objective space
5.2. Efficiency in solutions
5.3. The weighting method and constraint methods. Case studies.
5.4. Goal programming.

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

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

8. Waiting Lines and Queuing Theory and Modelling
8.1. Waiting line characteristics
8.2. Arrivals
8.3. Service
8.4. The M/M/1 model
8.5. The M/M/m model
8.6. Case studies

Methodology
The course uses the textbook by Render, Stair, and Hanna, “Quantitative Analysis for Management,” 11th edition, Prentice Hall, 2011. During lectures, case studies are discussed together with computational problem solving. Students have to turn in the assigned homework at the beginning of the class. Case studies can be prepared and presented by groups of at most 3 students.

Evaluation criteria
Homework assignments and case studies account for 40% of the grade, whereas 20% comes from oral presentations. The remaining 40% of the grade is determined by the final exam.
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Students are required to attend 80% of classes. Failing to do so without justified reason can have consequences in the final grade. As with all courses taught at the UPF Barcelona School of Management, students who fail the course during regular evaluation will be allowed ONE re-take of the examination/evaluation. If the course is again failed after the re-take, students may have to register again for the course the following year.

Bio of the professor

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 Pompeu Fabra University (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 vice-rector of the UPF from 2001 to 2013. Actually, he is the academic director of the school of Continuing Education at UPF.