



Quantitative Methods for Management

Professor: Daniel Serra
Office hours: by appointment

Course Description

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.

Objectives

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
<p>Instrumental</p> <ul style="list-style-type: none">• Organization and planning capacities.• Knowledge of software.• Problem solving.• Information search and processing <p>Interpersonal</p> <ul style="list-style-type: none">• Oral communication in public.• Teamwork.• capacity to write technical reports. <p>Systematic</p> <ul style="list-style-type: none">• Critical reasoning skills in both reading and writing communication.• Good analysis of qualitative and quantitative information.• Adaptation to new situations	<p>Academic and professional</p> <ul style="list-style-type: none">• 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



Methodology

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.

The teaching activities during the course will be as follows:

- 20 sessions of 1:30 hours each (10 weeks). Check Schedule of classes in the intranet of the course
- Students will have to hand out the homework at the beginning of the class each week (7 homeworks) using the intranet of the course in groups of maximum 3 students.

Attention: Homework and case studies must be presented by ALL students at most before the first session of the week, without exceptions.

Course Material, homework and case studies will be posted in eCampus.

Evaluation criteria

- Final exam: 80% of the grade. You need to obtain in this exam at least a 4 out of 10 to pass the course.
- Continuous evaluation (homeworks): 20% of the grade:
 - o 15% homeworks and case studies
 - o 5% paper presentation.

Students are required to attend 80% of classes. Failing to do so without justified reason will imply a Zero grade in the participation/attendance evaluation item and may lead to suspension from the program

Students who fail the course during the regular evaluation are allowed ONE re-take of the evaluation, in the conditions specified above. If the course is again failed after the retake, the student will have to register again for the course the following year.

In case of a justified no-show to an exam, the student must inform the corresponding faculty member and the director(s) of the program so that they study the possibility of

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rescheduling the exam (one possibility being during the “Retake” period). In the meantime, the student will get an “incomplete”, which will be replaced by the actual grade after the final exam is taken. The “incomplete” will not be reflected on the student’s Academic Transcript.

Plagiarism is to use another’s work and to present it as one’s own without acknowledging the sources in the correct way. All essays, reports or projects handed in by a student must be original work completed by the student. By enrolling at any UPF BSM Master of Science and signing the “Honor Code,” students acknowledge that they understand the schools’ policy on plagiarism and certify that all course assignments will be their own work, except where indicated by correct referencing. Failing to do so may result in automatic expulsion from the program.”

Calendar and Contents

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. Integer programming
 - 4.1. Problem formulation.
 - 4.2. The branch and bound procedure.
 - 4.3. The knapsack problem.
 - 4.4. Assignment problems.
5. Multiobjective programming
 - 5.1. Objective space.
 - 5.2. Efficiency in solutions
 - 5.3. The weighting method and constraint methods. Case studies.
 - 5.4. Goal programming: weighted and ranked methods
6. Network Models
 - 6.1. Network notation
 - 6.2. Minimum spanning tree
 - 6.3. Shortest Path
 - 6.4. Location problems
7. Project Management
 - 7.1. Critical Path Model

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Note: This document is for informational purposes only. Course contents and faculty may change.

- 7.2. PERT
- 7.3. PERT/CMP
- 7.4. Probabilistic PERT
- 7.5. Case study
- 8. Decision modelling
 - 8.1. Decision under uncertainty
 - 8.2. Decision under risk

Reading Materials/ Bibliography/Resources

Basic textbook:

- Render, B., Stair, R. & Hanna, M.E. (2021). Quantitative Analysis for Management, 11th 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
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- Winston, W. (2004). Excel Data Analysis and Business Modeling, Microsoft Press



Bio of Professor

Daniel Serra graduated in 1984 in Economics from the Autonomous University of Barcelona, and obtained a Master's Degree in Systems Analysis and his PhD in the Whiting School of Engineering at Johns Hopkins University in 1989. He is currently 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). He is actually the chairman of Department of Economics and Business at UPF.