

TEACHING PLAN
MASTER OF BUSINESS ADMINISTRATION
MBA FULL TIME
2023-2025

1. SUBJECT

- **Name: Quantitative Methods for Decision Making**
- **Type of subject: Compulsory**
- **Trimester: First**
- **Credits: 4 ECTS**
- **Teaching language: English**
- **Subject Coordinator: Andrea Saltelli**
- **Contact information: andrea.saltelli@gmail.com**
- **Subject Professor: Andrea Saltelli**
- **Contact information: andrea.saltelli@gmail.com**

2. PRESENTATION OF THE SUBJECT (objectives)

This course provides a comprehensive understanding of the application of quantitative models in addressing complex management and administration challenges, with a specific focus on effective decision-making. Designed for MBA students, it caters to two distinct groups: aspiring administrators seeking to leverage quantitative models for decision-making, and students in disciplines where decision-making plays a pivotal role, such as management, administration, and economics. Rather than striving for an exhaustive coverage of techniques, the course emphasizes the formulation of models and highlights how various existing techniques can contribute to problem-solving within organizations. While maintaining a minimal level of mathematical complexity, the course ensures that students gain a practical grasp of quantitative methods without requiring extensive prior mathematical knowledge.

Associated skills:

Skill in recognizing different type of problems amenable to a treatment using operational research. Computational skill to use graphical methods for simple problems and Excel solver for more complex ones. Skills in Python programming to program, plot and solve problems.

Learning outcomes:

The student has understood both the philosophy and the practice of operation research, and has some notion of the history of the discipline. She/he can judge which class of methods is more appropriate and solve them using spreadsheet or software. The student can estimate the existence of uncertainty and ways to incorporate them into the analysis. The student knows about both local and global sensitivity analysis. He has some understanding of when using meta-heuristic approaches.

3. LEARNING PLAN OF THE SUBJECT

	Main topics & contents
Session 1	A playful introduction. A brief recap of probability. A mini history of quantification and operation research. Based on Gass, S.I. and Assad, A.A. (2006) and Mann (2010).
Session 2	What is Operation Research? A prototype example. Assumption of linear programming. More examples. Method of simplex. Chapters 1,2,3, and 4 of Hillier (2014).
Session 3	Introduction to uncertainty and sensitivity analysis. What is a model? Methods for Uncertainty and sensitivity analysis. Based of chapter 7 of Hillier (2014) and Saltelli et al., 2008.
Session 4	The Transportation Problem. The Assignment Problems (sketched). Network Optimization Models. Integer Programming. Based on chapters 9,10 and 12 of Hillier (2014)
Session 5	Nonlinear Programming. Based on chapters 13 and 14 of Hillier (2014).
Session 6	Decision Analysis. Chapter 16 of Hillier (2014) plus various authors.
Session 7	Queueing Theory, chapter 17 of Hillier (2014). Programming and Planning. PERT and CPM, chapter 22 of Hillier (2014). Ethical considerations for OR, based on O'Neil, C. (2016), Saltelli et al., 2020, and other authors.

Teaching methods

Lessons in the classroom, with debates and hands on work on problems, both paper and pencil and software based. Group exercises. Homework.

Hours of dedication for lectures and student work: 100

4. EVALUATION CRITERIA

- a. En examen at the end of the course to test the practical and theoretical preparation of the students, that will account for 40% of the final mark.
- b. A practical exercise to be executed during the course, that will account for 40% of the final mark.

- c. An evaluation of the student's participation to the activities in the class during the course, that will account for 20% of the final mark.

5. PROFESSOR

Andrea Saltelli (<https://orcid.org/0000-0003-4222-6975>) has worked on physical chemistry, environmental sciences, applied statistics, impact assessment and science for policy. His main disciplinary focus is on sensitivity analysis of model output, a discipline where statistical tools are used to interpret the output from mathematical or computational models, and on sensitivity auditing, an extension of sensitivity analysis to the entire evidence-generating process in a policy context.

He has worked at the European Commission, leading between 2005 and 2015 a unit of econometrics and applied statistics. From November 2016 till June 2020 adjunct professor at the Centre for the Study of the Sciences and the Humanities (SVT) - University of Bergen (UIB). He is presently visiting researcher at UIB-SVT, associate researcher at Institute for Cognitive Sciences and Technologies of the Italian National Research Council (CNR) and academic counsellor at UPF Barcelona School of Management.

His most recent papers have tackled sensitivity analysis and auditing, science's reproducibility crisis, impact assessment, ethics of quantification, regulatory capture, rankings of higher education, science's integrity and the post-truth discussion. In summer 2023 a book entitled *The Politics of Modelling, Numbers Between Science and Policy*, was published by Oxford University Press, where he contributed as editor and author.

Andrea gives courses in sensitivity analysis, sensitivity auditing, science integrity, and ethics of quantification. Personal website: www.andreasaltelli.eu

6. BIBLIOGRAPHY

Gass, S.I. and Assad, A.A. (2006) *An Annotated Timeline Of Operations Research: An Informal History*. 2006 edition. New York: Springer-Verlag New York Inc.

Hillier, F.S. and Lieberman, G.J. (2014) *Introduction to Operations Research with Access Card for Premium Content*. 10^o edizione. McGraw Hill.

Mann, P.S. (2010) *Introductory Statistics*. 7th edn. Wiley. Available at: [https://drive.uqu.edu.sa/_/mshayat/files/MySubjects/20178FS%20Elementary%20Statistics/Introductory%20Statistics%20\(7th%20Ed\).pdf](https://drive.uqu.edu.sa/_/mshayat/files/MySubjects/20178FS%20Elementary%20Statistics/Introductory%20Statistics%20(7th%20Ed).pdf).

O'Neil, C. (2016) *Weapons of math destruction*. Random House Publishing Group.

Saltelli, A. et al. (2008) *Global sensitivity analysis: the primer*. John Wiley.

Saltelli, A. et al. (2020) 'Five ways to ensure that models serve society: a manifesto', *Nature*, 582, pp. 482–484.