Management Sciences and Operation Research

ECTS : 3

Enseignant responsable : Daniel VANDERPOOTEN (https://dauphine.psl.eu/recherche/cvtheque/vanderpooten-daniel)

Langue du cours : Français

Volume horaire : 27

Description du contenu de l'enseignement :

Many decisions are to be made at different levels of socio-economical organizations. This includes various types of decisions such as the optimal design of a production or distribution plan, inventory management policies, media planning, launching of a new product etc. The main difficulties to be handled are the potentially huge number of possible solutions and, sometimes, uncertainty in their evaluation. In order to support such decisions a formal approach is thus required.
The objective of the course is to provide an introduction to the main concepts and techniques for modeling and solving decision problems arising in socio-economical organizations. This course is on Moodle. 1 Presentation of the course. Management Science - Decision Aiding. Modeling. Basic concepts in graph theory. 2 The shortest path problem. Algorithms and applications. 3 Network flows. Concepts of flow and cut. Presentation of various flow problems. 4 The maximum flow problem: Ford-Fulkerson's theorem and algorithm. Modification of a network. 5 Linear programming. Introduction. Modeling examples. 6 Graphical method. The solver optimization module on Excel. **Mid-term exam** 7 Graphical sensitivity analysis and economical interpretation. Sensitivity analysis on Excel. 8 Integer linear programming. Modeling. Use of 0-1 variables (logical conditions, fixed charge...). 9 Elements of decision theory. Decision criteria under uncertainty and risk. Decision trees. Decision with additional information. Information value. 10 **Final Exam**

Compétences à acquérir :

At the end of this course, students will be able to:
1. Explain the main concepts and methods used in Management Science and Operations Research to support decision-making in organizations.
2. Identify decision problems in real-world contexts where formal modeling and optimization techniques are appropriate.
3. Apply basic modeling approaches (graphs, flows, linear and integer programming, decision theory) to structure and analyze simple decision problems.
4. Interpret the results of decision-aiding tools and assess their relevance and limitations for managerial decision-making.
5. Communicate effectively with specialists in Operations Research by understanding the key vocabulary, assumptions, and reasoning involved.

Pré-requis obligatoires

No prior knowledge is required, but basic skills and interest in mathematical formalism and logical reasoning are necessary.

Mode de contrôle des connaissances :

- Midterm Exam (test) 30%
- Final Exam: 50%
- Homework (cases) and class participation 20%
- Total 100%

The numerical grade distribution will dictate the final grade. The passing grade for a course is 10/20.
Attendance
Attendance is mandatory. Students are expected to attend all classes, arrive on time, and stay for the entire session. Repeated absences or lateness may affect the final grade.
Class Participation
Active participation is encouraged, as it contributes to making classes more engaging and instructive. Students are expected to come prepared and contribute thoughtfully to discussions. When participation is part of the course assessment, it is evaluated based on the quality of contributions rather than their quantity.
Exam Policy
Students are not allowed to bring any materials into exams, except those explicitly authorized by the instructor. Unexcused absences from exams or failure to submit assigned cases will result in a grade of zero when calculating final averages. All exams must be submitted at the end of the examination period.

Communication and Grading

All questions or concerns regarding grading or course policies must follow the official procedures. No direct negotiation with instructors about grades or assessments is permitted.

Be aware of the rules in Université Paris Dauphine about plagiarism and cheating during exams. All work turned in for this course must be your own work, or that of your own group. Working as part of a group implies that you are an active participant and fully contributed to the output produced by that group.

Bibliographie, lectures recommandées :

[1] F. S. Hillier and Lieberman G. J. Introduction to Operations Research. McGraw Hill, 10th edition, 2014.

[2] Ph. Vallin and D. Vanderpooten. Aide à la décision : une approche par les cas. Ellipses, Paris, 2000. 3e édition, 2006.

Reference [1] is a standard textbook. Reference [2] (in French) has been especially designed for this course. It contains additional problems with solutions.

Daniel Vanderpooten is a professor in computer science and operations research at Paris Dauphine University. His research interests are theoretical and practical aspects of decision aiding and operations research, more precisely multiobjective optimization, combinatorial optimization and robust optimization. He published about 100 articles in international journals and conferences. He is also head of the Master 2

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