

IE 443 Multi-objective Decision Analysis

Spring 2023

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Course Web Page: <https://courses.ie.bilkent.edu.tr/ie443>

Office Hours: By appointment

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Office: EA 305. Office hours: TBA.

Recommended Textbooks: There is no required textbook for this course. A set of articles will be provided, and additional readings will be distributed as needed.

Optional Textbooks:

- Strategic Decision Making: Multiobjective Decision Analysis with Spreadsheets, C. W. Kirkwood, Brooks/Cole, Cengage Learning, 1997.
- Multicriteria Optimization, M. Ehrgott, Springer Berlin, 2005.
- Decisions with Multiple Objectives: Preferences and Value Tradeoffs, R. Keeney and H. Raiffa, New York: Wiley, 1976

Course Summary:

Quantitative decision analysis. Structuring of objectives and value hierarchies, and determination of value functions. Introduction to consistent characterization of preferences under certainty. Value analysis under uncertainty including expected value analysis, utility theory, multi-attribute risk aversion, certainty equivalent calculations and the analytical hierarchy process.

Homework Assignments: A set of exercises will be assigned and graded.

Project: The course project involves applying one or more of the methods discussed in the class and conducting quantitative analysis on a bi-objective programming application. You will work on the project in groups of 3. You will need some familiarity with at least one LP/MIP solver (e.g. Xpress, CPLEX, Gurobi). Any one of these or another appropriate solver can be used.

Exams: There will be one in-class midterm and one in-class comprehensive final exam. The exams will be closed-books and closed notes. The exact dates and places will be announced during the semester.

Grading Policy: The overall score will be computed based on the following scheme:

Homeworks: 20% (4× 5 each)
Midterm Exam: 30 %
Final Exam: 35 %
Project: 15 %

Tentative Course Outline:

- Introduction to multicriteria decision making and multiobjective decision analysis
- Preferences Under Certainty: Value function based approaches, multiobjective value analysis
- Preferences Under Certainty: Methods not relying on value function evaluations
- Multi-objective Optimization Problems (MOPs): Categorization
- Solution concepts for MOPs
- Weighted Sum-Scalarization and its use for various biobjective programming problems
- Epsilon-Constraint Scalarization and its use for various biobjective programming problems
- Pascoletti-Serafini Scalarization and its use for various biobjective programming problems
- Decisions with Uncertainty, Utility Theory
- Multi-attribute Risk Aversion, Certainty Equivalent
- Multi-criteria Decision Making Applications in Operations Research

	Class Schedule	
Week of	Tuesdays	Thursdays
January 30	Lecture (2 hrs)	Lecture (2 hrs)
February 6	Lecture (2 hrs)	Lecture (2 hrs)
February 13	Lecture (2 hrs)	No class
February 20	Lecture (2 hrs)	Lecture (2 hrs)
February 27	Lecture (2 hrs)	No class
March 6	Spring break	Lecture (2 hrs)
March 13	Lecture (2 hrs)	Lecture (2 hrs)
March 20	No class	Midterm
March 27	Lecture (2 hrs)	No class
April 3	Lecture (2 hrs)	Lecture (2 hrs)
April 10	Lecture (2 hrs)	Lecture (2 hrs)
April 17	No class	No class
April 24	No class	Lecture (2 hrs)
May 1	Lecture (2 hrs)	Lecture (2 hrs)
May 8	Lecture (2 hrs)	Lecture (2 hrs)