



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Data Driven Strategies in Economics

2627-2-F7703M012

Learning objectives

The course deals with some important optimization problems arising in several fields of application such as manufacturing management, transportation and logistics. The aim of the course is to provide students with a classification of optimization problems related to networks and other applications. Further, the course aims at providing the students with the knowledge of a wide range of optimization models and methods. The students will learn to model optimization problems arising in real life applications, to represent them as particular case of well known optimization problems, and to deal with them applying both exact and heuristic approaches. Beside theoretical knowledge, the course will provide practical experience in developing and applying the optimization techniques. During the practical sessions, students will be asked to apply their theoretical knowledge to solve real-world problems using the AMPL software.

Contents

1. Network flow problems.
2. Flow routing and Fixed Charge Network Design problems.
3. Location problems.
4. Scheduling problems.

Detailed program

1. Network flow problems: maximum flow, minimum cost flow, minimum spanning tree, travelling salesman problem.
2. Flow routing and Fixed Charge Network Design problems: splittable vs unsplittable flow, single vs multiple paths, multicommodity flows, node and arc fixed costs. Arc-based and path-based ILP models. Vehicle

routing problems.

3. Location problems: set covering and set partitioning, p-center and p-median problems, uncapacitated and capacitated facility location problems, single assignment and multiple assignment.
4. Scheduling problems. Single machine scheduling with different objective functions (total weighted completion time, makespan, lateness, tardiness), parallel machines scheduling problems, flow shop, job shop.

Prerequisites

Basic knowledge of linear programming and simplex method are required.

Teaching methods

The course will provide a teaching activity of 42 hours divided as follows:

- 28 hours of face-to-face lectures conducted in in-person delivery mode;
- 14 hours of exercises conducted in interactive in-presence mode.

Assessment methods

The exam consists of a compulsory written test (exercises as a check on disciplinary problem solving skills) and an optional oral test (interview on topics covered in class). The written test is designed to test knowledge of modeling and decision problem solving techniques introduced during the course and the ability to implement optimization models using AMPL software.

Textbooks and Reading Materials

Reference books:

- F. Schoen, Optimization Models, 2024.
- R.K. Ahuja, T.L. Magnanti, J.B. Orlin, Network flows, Prentice Hall, 1993.
- M.S. Bazaraa, J.J. Jarvis, H.D. Sherali, Linear programming and network flows, Wiley and Sons, 1990.
- Z. Drezner, H.W. Hamacher, Facility Location: Applications and Theory, Springer, 2004.
- S. Martello, P. Toth, Knapsack problems, Wiley, 1990.
- M.L. Pinedo, Scheduling - Theory, Algorithms, and Systems, Springer, 2016.

Additional material will be provided during the course in the form of slides and solved exercises.

Semester

First semester.

Teaching language

Italian.

Sustainable Development Goals

QUALITY EDUCATION
