

DM872
Mathematical Optimization at Work

Introduction

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1. Course Organization

Who is here?

17 in total registered in BlackBoard

Prerequisites

- Programming
 - Linear Algebra
 - Linear and Integer Programming
- from DM545 (5 ECTS)**
who??

- Math-economy
(2nd year ?)
- Others?

from DM871 (5 ECTS)
who??

- Computer Science
(Master)
- Applied Mathematics
(2nd year ?)
- Others?

1. Course Organization

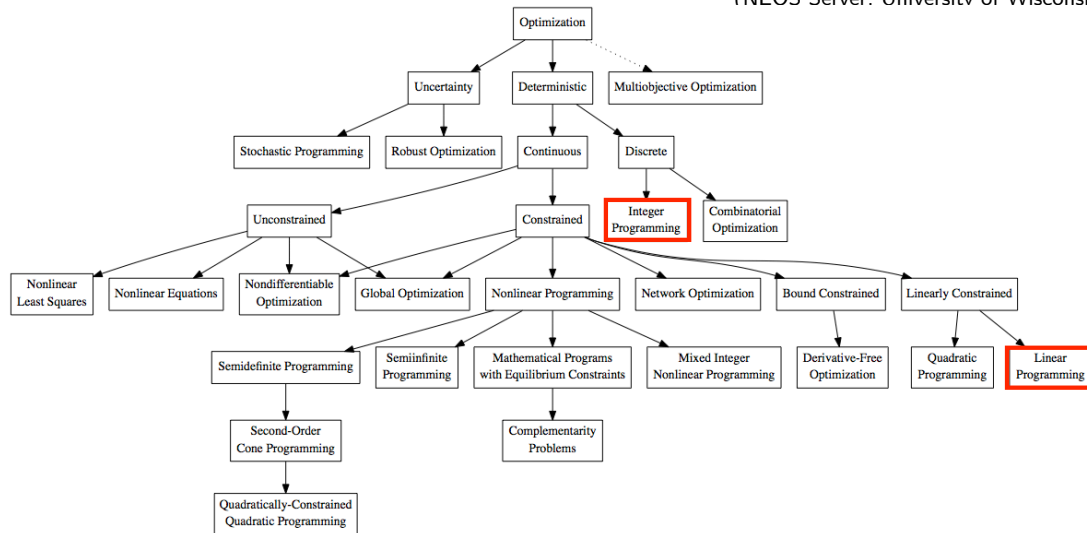
Learn about solving large scale, real-life problems with mixed integer linear programming:

- **advanced techniques** for integer linear programming
- Applications
- Implementations

→ You will see the theory and apply the tools learned to solve real life problems using computer software

Optimization Taxonomy

(NEOS Server. University of Wisconsin)



Contents of the Course (aka Syllabus)

Advanced mixed integer linear programming techniques

- 1 More on Modeling
- 2 Lazy Constraints
- 3 Dantzig-Wolfe decomposition
- 4 (Delayed) Column generation
- 5 Branch and price
- 6 Benders decomposition
- 7 Matheuristics

Applications

- 7 TSP
- 8 Educational Timetabling
- 9 Vehicle Scheduling
- 10 Crew Scheduling
- 11 Vehicle Routing with Time Windows
- 12 Machine Learning

Teacher: Marco Chiarandini (www.imada.sdu.dk/u/march/)

Instructor: None

Sections (hold): H1

Alternative views of the schedule:

- mitsdu.sdu.dk, SDU Mobile
- Official course description (læserplanen)
- <https://dm872.github.io>

Schedule:

- Introductory classes: \sim 30 hours (\sim 15 classes)
- Training classes: \sim 18 hours (\sim 9 classes)

- ItsLearning (LMS) \Leftrightarrow Main Web Page (WP)
(link <https://dm872.github.io>)
- **Announcements + Slides** in BlackBoard
- Write to Marco (marco@imada.sdu.dk)
- Ask peers
- You are welcome to visit me in my office in working hours (8-16)

\rightsquigarrow **Make the course interactive and fun!!**

Sources — Reading Material

Updated weekly.
Student's notes.

Public Web Page (WP) is the main reference for list of contents

It contains:

- list of topics and references
- exercises
- links
- resources for programming tasks

- Two obligatory medium size projects, evaluation by external censor
- Individual work
- (language: Danish and/or English)
- Final grade: overall evaluation but as starting point the average grade rounded up

- Python 3.10+
- Previous years:
 - Gurobi 9.1+ (commercial 100 000 DKK, alternative Cplex, Express)
 - SCIP Optimization Suite + PyScipOpt (Commercial alternative Gurobi or Cplex \approx 100 000 Dkk)
 - GLPK or SCIP + Pyomo
- This year:
 - gurobipy, Gurobi 10+ (commercial 100 000 DKK, alternative Cplex, Express)
 - SCIP Optimization Suite + PyScipOpt (Commercial alternative Gurobi or Cplex \approx 100 000 Dkk)
 - Python-MIP + CBC or Gurobi 10+
- ipython, jupyter, jupyterLab (= interactive python) or Google CoLab
- VS Code, Spyder3.