

## MATH-460 **Combinatorial optimization**

Cursus	Sem.	Type
Data Science	MA1, MA3	Opt.
Electrical Engineering		Obl.
Ing.-math	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

### Remark

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### Summary

The guiding question of Combinatorial Optimization is: How do I efficiently select an optimal solution among a finite but very large set of alternatives? We will address the solution of this question in the context of classical discrete optimization problems.

### Content

- Paths and flows: Strongly polynomial time algorithms for shortest paths and minimum cost network flows
- Minimum spanning trees and matroids: Greedy, Kruskal's and Prim's algorithm
- Arborescences and matroid intersection
- Polyhedra and approximation algorithms
- Maximum weight matchings in general graphs and the matching polytope

### Keywords

- Algorithm
- Polyhedron
- Matroid
- NP-completeness

### Learning Prerequisites

#### Required courses

Discrete optimization (Second year math.)

### Learning Outcomes

By the end of the course, the student must be able to:

- Choose an appropriate method for solving a combinatorial optimization problem
- Prove theorems in discrete optimization

- Design algorithms
- Analyze efficiency of algorithms

### Transversal skills

- Demonstrate a capacity for creativity.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.

### Teaching methods

Ex cathedra lecture and exercises to be solved at home and in the classroom

### Expected student activities

Attendance of lectures and exercises  
Completion of exercises at home  
Study of literature

### Assessment methods

Written exam during exam session

### Supervision

Office hours	Yes
Assistants	Yes
Forum	No

### Resources

#### Bibliography

Alexander Schrijver, Combinatorial Optimization: Polyhedra and Efficiency, Springer-Verlag.