

MATH-261

**Discrete optimization**

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Cursus	Sem.	Type
Chemistry	BA6	Opt.
Electrical and Electronical Engineering	MA2, MA4	Opt.
Energy Science and Technology	MA2, MA4	Opt.
Mathematics	BA4	Opt.

Contact language	English
Credits	5
Session	Summer
Semester	Spring
Exam	Written
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

This course is an introduction to linear and discrete optimization. Warning: This is a mathematics course! While much of the course will be algorithmic in nature, you will still need to be able to prove theorems.

**Content**

- Optimization techniques
- Algorithms and complexity
- Linear Programming
- Simplex Algorithm
- Duality Theory
- Integer Programming and relaxations
- Network flows

**Keywords**

Linear Programming, Algorithms, Complexity, Graphs, Optimization

**Learning Prerequisites****Required courses**

Linear Algebra

**Recommended courses**

Discrete Mathematics or Discrete Structures

**Important concepts to start the course**

The student needs to be comfortable reading and writing formal mathematical proofs.

**Learning Outcomes**

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

- Choose appropriate method for solving basic discrete optimization problem
- Prove basic theorems in linear optimization

- Interpret computational results and relate to theory
- Implement basic algorithms in linear optimization
- Describe methods for solving linear optimization problems
- Create correctness and running time proofs of basic algorithms
- Solve basic linear and discrete optimization problems

### Transversal skills

- Continue to work through difficulties or initial failure to find optimal solutions.
- Use both general and domain specific IT resources and tools

### Teaching methods

Ex cathedra lecture, exercises in the classroom and with a computer

### Expected student activities

- Attendance of lectures and exercises
- Completion of exercises
- Solving supplementary programs with the help of a computer

### Assessment methods

Written exam during the exam session

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

### Resources

#### Bibliography

Dimitris Bertsimas and John N. Tsitsiklis: Introduction to Linear Optimization, Athena Scientific

#### Ressources en bibliothèque

- [Introduction to Linear Optimization / Bertsimas](#)

#### Notes/Handbook

Lecture notes

#### Moodle Link

- <https://go.epfl.ch/MATH-261>