

## Optimisation (C003563)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits** 6.0

**Study time** 165 h

### Course offerings and teaching methods in academic year 2024-2025

A (semester 1)

Dutch

Gent

lecture

seminar

### Lecturers in academic year 2024-2025

Fack, Veerle

WE02

lecturer-in-charge

Freson, Steven

WE02

co-lecturer

### Offered in the following programmes in 2024-2025

[Bachelor of Science in Mathematics](#)

**crdts**

6

**offering**

A

### Teaching languages

Dutch

### Keywords

Optimisation in  $R^n$ , Gradient method, Newton method, Linear programming, Lagrange's theorem, Kuhn-Tucker's theorem, Combinatorial optimisation, Graphs, Greedy algorithms, Dynamic programming, Branch and Bound, Approximation algorithms

### Position of the course

This course aims at stimulating the creative scientific thinking of the students, as well as developing their ability to formulate, model and solve specific optimisation problems from different scientific application areas. The course offers a broad perspective on different aspects of mathematical optimisation, including definition of the problems, techniques for solving the problems, and areas of application.

### Contents

Classification of optimisation problems: univariate, multivariate, continuous, discrete, combinatorial, linear, quadratic, non-linear, with or without constraints. Optimisation in  $R^n$ : gradient methods, Newton methods, global search algorithms. Linear programming, simplex method and dual problems. Optimisation in  $R^n$  with equality constraints: Lagrange's theorem. Optimisation in  $R^n$  with inequality constraints: Kuhn-Tucker's theorem. Greedy algorithms: optimal caching, interval scheduling, Huffman codes. Dynamic programming: change problem, all-pairs shortest path, longest path in a directed acyclic graph, approximate string matching. Branch-and-bound and approximation algorithms: knapsack problem, travelling salesman problem, maximum cliques, genome rearrangements.

### Initial competences

Final competences of the course Algorithms and Data Structures.

### Final competences

The student has acquired the ability to recognise the type of optimisation problem and to choose the most appropriate technique for solving it. He/she can solve simple optimisation problems, either with analytical techniques or using suitable computer software, and he/she is able to perform an efficiency analysis of the method used.

### Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

### **Teaching methods**

Seminar, Lecture

### **Study material**

Type: Syllabus

Name: Optimisation: partim continuous optimisation

Indicative price: Free or paid by faculty

Optional: no

Language : Dutch

Available on Ufora : Yes

Type: Syllabus

Name: Syllabus: Discrete Optimalisatie

Indicative price: Free or paid by faculty

Optional: no

Language : Dutch

Available on Ufora : Yes

Type: Slides

Name: Optimisation: partim continuous optimisation

Indicative price: Free or paid by faculty

Optional: yes

Language : Dutch

Available on Ufora : Yes

Type: Handouts

Name: Handouts: Discrete Optimalisatie

Indicative price: Free or paid by faculty

Optional: no

Language : Dutch

Available on Ufora : Yes

### **References**

E. Chong and S. Zak, An Introduction to Optimization, 3rd ed. (Wiley, 2008).

W. Kocay and D.L. Kreher, "Graphs, Algorithms and Optimization", CRC Press, 2005.

### **Course content-related study coaching**

#### **Assessment moments**

end-of-term and continuous assessment

#### **Examination methods in case of periodic assessment during the first examination period**

Written assessment

#### **Examination methods in case of periodic assessment during the second examination period**

Written assessment

#### **Examination methods in case of permanent assessment**

Oral assessment, Assignment

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is not possible

#### **Calculation of the examination mark**

End-of-term evaluation: 90%

Continuous assessment: 10%