

## Optimisation Techniques (E004120)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)  
Credits 6.0 Study time 180 h Contact hrs 60.0 h

### Course offerings and teaching methods in academic year 2020-2021

Offering	Language	Location	Teaching Methods	Hours
A (semester 2)	Dutch	Gent	lecture	30.0 h
			seminar: coached exercises	30.0 h
B (semester 2)	English		guided self-study	60.0 h

### Lecturers in academic year 2020-2021

Philips, Wilfried	TW07	lecturer-in-charge
Jovanov, Ljubomir	TW07	co-lecturer

### Offered in the following programmes in 2020-2021

Programme	crdts	offering
<a href="#">Brugprogramma Master of Science in Bioinformatics (main subject Engineering)</a>	6	B
<a href="#">Master of Science in Electrical Engineering (main subject Communication and Information Technology )</a>	6	A
<a href="#">Master of Science in Bioinformatics (main subject Engineering)</a>	6	B
<a href="#">Master of Science in Computer Science Engineering</a>	6	A
<a href="#">Master of Science in Computer Science Engineering</a>	6	A
<a href="#">Exchange Programme in Bioinformatics (master's level)</a>	6	B

### Teaching languages

Dutch, English

### Keywords

linear programming, optimisation, integer and binary programs, network flows

### Position of the course

To familiarize the students with the most important optimization problems with discrete and continuous variables: to teach the students to formulate these problems mathematically starting from a practical problem definition, and to solve them with appropriate algorithms.

### Contents

- Introduction: Overview
- Graph algorithms: spanning trees, shortest paths, dynamic programming
- Linear programs: basic principles, simplex algorithm, internal search, duality and sensitivity, multi-objective problems
- Discrete optimisation: lumpy linear programs, methods, assignment problems, routing problems
- Non-linear programs with continuous variables: principles, improving search, constrained programs, important special cases
- Network flows: flow-improving paths and cycle-cancelling, network simplex

### Initial competences

Working knowledge of Dutch.

### Final competences

- 1 Understanding concepts such as relaxation, dualisation of constraints, partial solutions...
- 2 Being able to develop an algorithm starting from basic principles.
- 3 Having insight into algorithms and the conditions under which they can be applied.

4 Having insight into the possible solutions and the possible locations of optima.

#### 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

Guided self-study, lecture, project, seminar: coached exercises

#### Extra information on the teaching methods

Classroom lectures; Classroom problem solving sessions; Project

#### Learning materials and price

Robert J. Vanderbei. Linear Programming Foundations and Extensions. International Series in Operations Research and Management Science, Vol. 37, 2nd ed., 2001, 472 p., Hardcover ISBN: 0-7923-7342-1. <http://www.princeton.edu/~rvdb/LPbook/online.html>

Optimization in Operations Research. Ronald L. Rardin. Prentice hall, 1998. ISBN 0-02-39815-5

#### References

- zie <http://telin.rug.ac.be/~philips/optimalisatie/optimalisatie.php#Studiemateriaal>
- Robert J. Vanderbei. Linear Programming Foundations and Extensions. International Series in Operations Research and Management Science, Vol. 37, 2nd ed., 2001, 472 p., Hardcover ISBN: 0-7923-7342-1. <http://www.princeton.edu/~rvdb/LPbook/online.html>
- R.L. Rardin. Optimization In Operations Research. Prentice Hall, 1998. ISBN: 0-02-398415-5.
- J.R. Evans and E.~Minieka. Optimization Algorithms for Networks and Graphs. Marcel Dekker, 2nd edition, 1992. ISBN 0824786025
- A. Dolan and J. Aldoes. Networks and Algorithms. An Introductory Approach. John Wiley, 1999. ISBN 0-471-93993-5.
- W.J. Cook, W.H. Cunningham, W.R. Pulleyblank, and A. Schrijver. Combinatorial Optimization. Wiley, 1998. Interscience Series in Discrete Mathematics and Optimization.
- R.G. Parker and R.L. Rardin. Discrete Optimization. Academic Press, 1988. ISBN: 0-12-545075-3.
- H.A. Taha. Operations Research. An introduction. Prentice Hall, sixth edition, 1997. ISBN: 0-13-272915-6
- W.H. Press, B.P. Flannery, S.A. Teukolsky and W.T. Vetterling. Numerical Recipes in C. Cambridge University Press. 1986
- Gill, Murray en Wright. Practical optimization. Academic Press. 1982. ISBN: 0122839528.
- N. Hartsfield and G. Ringel. Pearls in Graph Theory. A comprehensive introduction. Academic Press, 1994. ISBN: 0-12-328553-4.

#### Course content-related study coaching

#### Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination, open book examination

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

Written examination, open book examination

#### Examination methods in case of permanent evaluation

Report

#### Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

#### Extra information on the examination methods

During examination period: written open-book exam; written closed-book exam

During semester: graded project reports. Second chance: Not possible

Frequency: 1x

#### Calculation of the examination mark

Evaluation throughout semester as well as during examination period