

## Optimisation Techniques (E004120)

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

**Credits 6.0**

**Study time 180 h**

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

A (semester 2)

English

Gent

lecture

seminar

**Lecturers in academic year 2024-2025**

Jovanov, Ljubomir

TW07

lecturer-in-charge

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

	<b>crdts</b>	<b>offering</b>
<a href="#">Bridging Programme Master of Science in Bioinformatics(main subject Engineering)</a>	6	A
<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	A
<a href="#">Master of Science in Computer Science Engineering</a>	6	A

**Teaching languages**

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

Seminar, Lecture

### Extra information on the teaching methods

Classroom lectures; Classroom problem solving sessions; Project

### Study material

Type: Handbook

Name: Handboek

Indicative price: Free or paid by faculty

Optional: no

Language : English

Online Available : Yes

Available in the Library : Yes

Additional information: Robert J. Vanderbei: "Linear Programming Foundations and Extensions", International Series in Operations Research and Management Science, Vol. 37, 2nd edition, 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, via UGent library: <https://lib.ugent.be/catalog/ebk01:4100000011223356>

### References

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- 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

#### 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

Assignment

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

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