

# Course Specifications

From the academic year 2016-2017 up to and including the academic year

# Optimisation Techniques (E004120)

Due to Covid 19, the education and assessment 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 18	0 h Cont	act hrs	60.0h		
Course offerings and te	aching methods in academic y	ear 2021-2022				
A (semester 2)	Dutch	Gent	se	minar: coached e	exercises	30.0h
			le	cture		30.0h
B (semester 2)	English	Gent	gu	guided self-study		60.0h
Lecturers in academic y	ear 2021-2022					
Jovanov, Ljubomir	Jovanov, Ljubomir TW07			lecturer-in-charge		
Philips, Wilfried			TW07	co-lecturer		
Offered in the following programmes in 2021-2022				crdts	offering	
Bridging Programme Master of Science in Bioinformatics(main subject Engineering)				6	В	
Master of Science in Electrical Engineering (main subject Communication and Information Technology )				on 6	А	
Master of Science in Bioinformatics(main subject Engineering)				6	В	
Master of Science in Computer Science Engineering				6	А	
Master of Science in Computer Science Engineering				6	А	
Exchange Programme in Bioinformatics (master's level)				6	В	

#### Teaching languages

English, Dutch

#### 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.<sup>~</sup>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 examination, Open book examination

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

Written examination, Open book examination

#### Examination methods in case of permanent assessment

Report

# 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