

FMAF35 Linear and Combinatorial Optimization 2019

Lecturer:

Sara Maad Sasane

MH:454C, **phone:** 046-222 0519, **email:** sara@maths.lth.se

Assistant in the laboratory exercises:

Marcus Valtonen-Örn hag

MH:427, **phone:** 046-222 87 51, **email:** marcus.valtonen_ornhag@math.lth.se

Lectures:

Tuesdays 10–12 and Fridays 10–12.

The last lecture will be on 5/3 (a Tuesday). See TimeEdit for the rooms of the lectures.

Laboratory exercises:

There are two mandatory computer exercises in the course. See the course webpage for the time and place.

Literature:

Kolman, B. and Beck, R. E. *Elementary Linear Programming with Applications*, Academic Press 1995. This book is available as an ebook (free for students at Lund University) from Lund University Library.

You may also need one of the following (or read the lecture notes for these topics instead):

Holmberg, K., *Optimering*, Liber 2010, ISBN 978-91-47-09935-1 or

Papadimitriou, C. H. and Steiglitz, K. *Combinatorial Optimization:*

Algorithms and Complexity, Dover 1998, ISBN 0-486-40258-4

Preliminary plan for lectures:

The rightmost column below indicates suggested reading. (**KB** refers to the book by Kolman and Beck, and similar for the books by the other authors.)

Tu	22/1	Introduction and Basic concepts Convexity Combinatorial vs Linear Optimization	PS Ch. 1.1, H Ch. 1. KB Ch. 1.3–1.4, PS Ch. 1.4–1.6. PS Ch. 1.2.
Fr	25/1	The Simplex method	KB Ch. 1.5 and 2.1, (2.2).
Tu	29/1	The Simplex method and duality	KB Ch. 2.3 and 3.1.
Fr	1/2	Duality, cont.	KB Ch. 3.2, (Ch. 3.3).
Tu	5/2	Integer programming The cutting plane method	KB Ch. 4.1–4.2.
Fr	8/2	Integer programming cont. The branch and bound method The travelling salesman problem	KB Ch. 4.3.
Tu	12/2	Transportation problem	KB Ch. 5.1.
Fr	15/2	Assignment problem	KB Ch. 5.2.
Tu	19/2	Graphs and networks Maximal flow problem The Vigenère cipher – Theory for Lab 2	KB Ch. 5.3. KB Ch. 5.4.
Fr	22/2	Algorithm complexity Ellipsoid algorithm, Central Path method	H Ch. 15 or PS Ch. 15.
Tu	26/2	The shortest route problem Dynamic programming	KB Ch. 5.5. H Ch. 11.3–11.4 or PS Ch. 18.6.a
Fr	1/3	Simulated annealing Genetic algorithms	H Ch. 16.5 or lecture notes
Tu	5/3	Applications of linear programming Regression analysis Linear classification (machine learning)	Extra material and lecture notes

Course requirements:

In the course, there are two mandatory computer exercises, three mandatory hand-in exercises and a written exam, which will take place on Monday 18 March between 08.00 and 13.00.

To do list

Before coming to each lecture, read through the relevant chapters so that you know roughly what the lecture will be about. After the lecture, read the relevant book chapter again, and do the following recommended exercises:

L1	KB 1.3.13 , 14, 17–24, 28, 29, 32, 35, 1.4.1 , 4, 5, 9, 10.
L2	KB 1.1.2 , 3, 5, 8, 1.5.1 , 3, 5, 8, 12. 2.1.1 , 3, 6, 8, 20, 24.
L3	KB 2.3.1a , 5, 7, 20, 24, 3.1.2 , 3, 7, 11.
L4	KB 3.2.1 , 2, 3, 4, 5, 6, 8, 10,
L5	KB 4.1.1 , 3, 5, 4.2.1 , 3, 6, 8, 9.
L6	KB 4.3.1 , 4, 6, 7, 14.
L7	KB 5.1.3 , 7, 10, 11, 16, 17, 18.
L8	KB 5.2.1 , 3, 7.
L9	KB 5.3.1 , 5, 7, 8, 5.4.1 , 5, 8, 9, 5.5.1 , 4.
L10	H 15.2.1 .
L11	H 13.4.7b , 9b.

In the last part of each lecture, we will discuss some of the recommended exercises from the previous lecture.