FMAF35 Linear and Combinatorial Optimization 2020

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

Assistant in the laboratory exercises:
Marcus Valtonen-Örnhag
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 3/3 (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	21/1	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	24/1	The Simplex method	**KB** Ch. 1.5 and 2.1, (2.2).
Tu	28/1	The Simplex method and duality	**KB** Ch. 2.3 and 3.1.
Fr	31/1	Duality, cont.	**KB** Ch. 3.2, (Ch. 3.3).
Tu	4/2	Integer programming The cutting plane method	**KB** Ch. 4.1–4.2.
Fr	7/2	Integer programming cont. The branch and bound method The travelling salesman problem	**KB** Ch. 4.3.
Tu	11/2	Transportation problem	**KB** Ch. 5.1.
Fr	14/2	Assignment problem	**KB** Ch. 5.2.
Tu	18/2	Graphs and networks Maximal flow problem The Vigenère cipher – Theory for Lab 2	**KB** Ch. 5.3. **KB** Ch. 5.4.
Fr	21/2	Algorithm complexity Ellipsoid algorithm, Central Path method	**H** Ch. 15 or **PS** Ch. 15.
Tu	25/2	The shortest route problem Dynamic programming	**KB** Ch. 5.5. **H** Ch. 11.3–11.4 or **PS** Ch. 18.6.a
Fr	28/2	Simulated annealing Genetic algorithms	**H** Ch. 16.5 or lecture notes
Tu	3/3	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 16 March between 14.00 and 19.00.

To do list
Before coming to each lecture, read through the relevant chapters in the main course book **KB** 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.

There are no excercise sessions in this course, but there will be time to ask me questions about the exercises at the end of each lecture. I also encourage you to use the Discussions page in the Canvas course page.