186.835 VU
Mathematical Programming

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Overview

Focus on theory and practical aspects of

Mixed Integer Linear Programming (MIP)

You should have:

- interest in optimization
- basic knowledge of (integer) linear programming ("Algorithmics")
- programming skills in C++ or Java or whatever
- basic knowledge of graph theory and linear algebra

Aim of Course

- Have a broader knowledge in the area of mathematical optimization
- Be able to model both academic and real world problems as MIPs
- Be able to theoretically analyze and compare different mathematical programming formulations for a problem
- Have knowledge on common methodology for solving MIPs
- Be able to develop solution algorithms using MIP frameworks
- Be aware of certain generalizations / extensions

Organization and Modalities

- **Important: Please register via TISS!** (until end of March)
- All course information is available in **TUWEL**
- **Slide-based video lectures, Q&A live sessions**
- **Homework exercises** (max. 20 points):
  - prepare exercises at home (≈ 12 in total)
  - upload solutions in TUWEL
  - get individual feedback from us
  - teamwork is ok (≤ 2), but let us know (in your document)
  - ok to use references (e.g., articles, books) but cite them!
- **Programming exercises** (max. 40 points) $\rightarrow$ discussed in separate slides/video
- **Written online exam** (max. 40 points)
- Grading and requirements for positive grade:
  - ≥ 30 **points for homework and programming exercises**
  - ≥ 20 **points in written exam**
  - 0-49: **5**, 50-62: **4**, 63-75: **3**, 76-88: **2**, 89-100: **1**

Literature

Most parts of this course follow

- L. A. Wolsey, *Integer Programming*, Wiley, 1998
- M. Jünger et al., editors, *50 Years of Integer Programming 1958-2008*, Springer, 2010.

Further literature:

- T. L. Magnanti and L. A. Wolsey, *Optimal Trees*, In M. O. Ball et al., editors, Network Models, Handbooks in Operations Research and Management Science, Vol. 7, Elsevier, 1995
- D. Bertsimas and R. Weismantel, *Optimization over Integers*, Dynamic Ideas, 2005
- G. Nemhauser and L. A. Wolsey, *Integer and Combinatorial Optimization*, Wiley, 1999.
- A. Schrijver, *Theory of Linear and Integer Programming*, Wiley, 1986.
- W. J. Cook, *In Pursuit of the Traveling Salesman: Mathematics at the Limits of Computation*, Princeton University Press, 2011

Further useful resources

- Mathematical Optimization Society, `http://mathopt.org`
- INFORMS Computing Society, Mathematical Programming Glossary, `http://glossary.computing.society.informs.org`
- NEOS Wiki, `http://www.neos-guide.org`