03-IMAT-APX	Approximation Algorithms

Lehrform *(teaching format)* / **SWS** *(hours per week)*: 4K

Kreditpunkte *(credit points)*: 6

Turnus *(frequency)*: usually, each summer term

Inhaltliche Voraussetzungen *(content-related prior knowledge/skills)*: basic knowledge in algorithms theory, complexity, graphs

Sprache *(language)*: English

Lehrende *(teaching staff)*: AG Kombinatorische Optimierung und Logistik (Prof. Dr. Nicole Megow)

Studiengang *(degree program)*	Module	Semester
Informatik (Master)	IMAT, IMA-SQ, IMVT-AI, IMVT-VMC	ab 1.Sem.
(Techno)Mathematik (Master)	WP, Vertiefung Algebra/Numerik	
Informatik (Bachelor)	(nur *Freie Wahl*)	

Lernergebnisse / *Learning Outcome*:

- to have a comprehensive understanding of approximation algorithms for combinatorial optimization problems
- to know several fundamental combinatorial optimization problems and be able to formulate them
- be able to analyze the running time and approximation guarantee of algorithms
- to know and apply general techniques for designing new approximation algorithms
- be able to establish approximability and non-approximability results for optimization problems

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Inhalte / *Contents*:

This course gives a comprehensive overview on techniques for solving computationally intractable (NP-hard) combinatorial optimization problems while providing strong mathematical guarantees on the algorithm's performance in comparison to the optimum solution. The lectures will consist of designing polynomial-time algorithms and proving rigorous bounds on their worst case performances. The course covers the following topics:

- greedy algorithms and local search
- rounding data and dynamic programming, polynomial-time approximation schemes
- deterministic rounding of linear programs (LPs)
- random sampling and randomized rounding of LPs
- prima-dual methods
- hardness of approximation
- combinatorial optimization problems such as Minimum Steiner/Spanning Trees, Scheduling, Facility Location, Set Cover, etc.

Hinweise *(remarks)*: The table lists only the primary / most specific modules to which this course is assigned.