**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)

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

**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.