Combinatorial optimization

Offered by: W & I
Language: Dutch (first and second course) English (third course)
Primarily interesting for: Technische Wiskunde
Prerequisites: Linear algebra, analysis, set theory and algebra
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Content and composition
Combinatorial optimization is concerned with selecting the best from a finite set of discrete alternatives. A classical example is the travelling salesman problem, where the goal is to determine the shortest tour passing through a given set of cities. Even when it is clear that there is just a finite set of possible routes, it is not practically feasible to select the best by enumerating all possibilities. Problems such as this are common in science and business, arising as scheduling, routing, packing and rostering problems.

The key problem of combinatorial optimization is to develop algorithms for solving such problems efficiently or for finding a reasonable approximation to the best possible solution in limited time. This package gives an introduction to several basic mathematical tools for analyzing and solving such combinatorial optimization problems: graph theory, linear and integer linear optimization, and a catalogue of standard algorithms.

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Course descriptions

Optimization
Theory and practice of linear and integer linear optimization. LP duality theorem. The simplex algorithm, and more advanced methods such as column generation and cutting plane algorithms. Totally unimodular matrices and network optimization.

Graph theory and combinatorics
Algorithms

General techniques for solving optimization problems (backtracking, dynamic programming, and greedy algorithms), algorithms for optimization in graphs (shortest paths, flows and matchings) as well as the theory of NP-completeness.