Combinatorial optimization

Combinatorial optimization

The course is devoted to exact optimization algorithms for combinatorial problems solvable in polynomial time, such as

- Min cost spanning tree
- Min cost spannning arborescence
- One-to-one and one-to-many shortest paths
- All-pairs shortest paths
- Max flow and min cost flow
- Min cost bi-partite matching
- and others...

Algorithmic ideas and data-structures are compared on the basis of the resulting computational complexity.

Combinatorial optimization

The main objective is to understand the techniques that can be used
- to design optimization algorithms (linear duality theory)
- to assess their computational complexity
- to implement them efficiently.

The course is suitable for students with a specific interest in algorithms and discrete optimization.

It is a good starting point for the development of a master thesis.

Prerequisites:
- Computer programming, Algorithms and data-structures
- Operations research

Combinatorial optimization

The exam can be passed in two ways:

- a computational project, in which one or more algorithms are designed, implemented and tested;

- a seminar on a scientific paper concerning polynomial-time combinatorial optimization.

Before the project/seminar, a preliminary short exam is needed to verify that the student is able to pass the xam.

After the project/seminar, an oral exam is done on the remaining part of the course.

Combinatorial optimization

The course belongs to the «Analytics and Optimization» stream.

It can be well-complemented with other courses in

- Statistics, data science
- Numerical analysis, applied mathematics
- Machine learning
- Operations research
  - Operational Research Complements
  - Heuristic algorithms for combinatorial optimization
  - Simulation
  - Decision Models and Methods
  - Logistics