Computational Aspects of Optimization 2021

Topics included in the exam:

- Simplex and dual simplex algorithm – detailed description of the iterations
- Benders decomposition (LP in details, basic principle for two-stage and CVaR problems)
- Properties of the feasibility set of linear integer problems
- Introduction to the computational complexity
- Ability to formulate a problem using integer (binary) variables
- Network-flows and total unimodularity
- Subcycle elimination conditions for the traveling salesman problem (including time windows)
- Vehicle routing problem – basic formulation
- Lagrangean duality – duality theorems and consequences, application to LP and QP, generalized Benders decomposition
- Basic ideas of the following algorithms:
    - MIP: Branch & Bound, Gomory cuts
    - NLP: Alg. based on directions, Cutting plane method, Interior Point Method, barrier and penalty functions, Sequential Quadratic Programming
- Algorithm convergence theorem
- Zero-sum games of two players, the minimax theorem, matrix games
- Dynamic programming – Bellman principle, optimality conditions, forward and backward recursion (basic ideas)

Topics NOT included in the exam:

- Nested Benders decomposition
- Duality in integer programming
- Concrete integer programming problems (lot-sizing, unit commitment, …)
- Proof of the strong duality theorem
- Support Vector Machines (L. duality)
- Stochastic transportation problem