Exact and approximate solution of Combinatorial Optimization problems

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1. Introduction to combinatorial optimization and computational complexity
   (Approx 5 hours. Recommended as a preliminary course for students who did not attend a postgraduate course in Operations Research)
   - combinatorial optimization;
   - linear programming and duality;
   - integer linear programming;
   - optimization problems on graphs;
   - exact and approximate solutions;
   - classes \( \mathcal{P} \) and \( \mathcal{NP} \);
   - \( \mathcal{NP} \)-complete problems;
   - strongly \( \mathcal{NP} \)-complete problems.

2. Approximate solution of combinatorial optimization problems
   (Approx 5 hours. Mandatory for PhD students in Automatics and Operations Research. Recommended as a preliminary course for students who did not attend a postgraduate course in Operations Research)
   - combinatorial optimization problems;
   - approximation algorithms;
   - heuristic algorithms;
   - meta-heuristic algorithms.

3. Matching and assignment problems (Approx 20 hours)
   - introduction;
   - theoretical foundations (the matching problem and the early years of combinatorial optimization);
• applications of maximum matching;
• linear sum assignment problem: the Hungarian algorithm;
• other linear assignment problems:
  – ranking assignment problem solutions;
  – $k$-cardinality assignment problem;
  – bottleneck assignment problem;
  – balanced assignment problem;
• quadratic assignment problems:
  – formulations and bounds;
  – exact and heuristic algorithms

Reference text:

Home page: www.assignmentproblems.com