Discrete and Continuous Optimization 1 Exam Topics, Spring 2022

1. Conservative costs, feasible potential. Bellman-Ford algorithm, Gallai's theorem

2. Ford-Fulkerson algorithm for maximum flow. Algorithm for cheapest flow of size k. Maximum matching in bipartite graphs, Kőnig's Theorem, perfect matchings in regular bipartite graphs

3. Maximum weight perfect matching in bipartite graphs. Assignment problem, Transportation problem.

4. Totally unimodular matrices. Integer solutions of totally unimodular systems of linear inequalities. Examples: cheapset flow, maximum weight matching

5. Cutting plane methods: Gomory-Chvátal cuts, Gomory integer cuts, covering cuts, clique cuts

6. Approximation algorithms for the knapsack problem and the minimum cost vertex cover problem. Greedy algorithms for minimum cost spanning tree.

7. 2-approximation algorithms for the Steiner tree problem and the Traveling Salesman Problem. Christofides' 3/2-approximation algorithm for the Traveling Salesman Problem.

8. Algorithm for finding a minimum cost spanning arborescence

9. Matroids, examples: Graphic matroid, partition matroid, uniform matroid, transversal matroid, linear matroid. The greedy algorithm for finding a maximum weight basis.

10. Deletion, contraction, dual matroid. The matroid intersection problem. Algorithm for finding a maximum weight common independent set.