Matroid Parity

Graduate Seminar on Discrete Optimization, Summer 2019

1. **The matroid matching problem** (equivalence of matroid matching, 2-polymatroid matching, and the matchoid problem; Gallai theorem; hardness)

   Schrijver [2003]: Combinatorial Optimization: Polyhedra and Efficiency; Sections 43.2, 43.3, 43.7, 43.9

   Lovász, Plummer [1986]: Matching theory; Section 11: p. 410 - 416

   (see also *Jensen, Korte [1982]: Complexity of matroid property algorithms*)

2. **A min-max formula for maximum size matroid matching**

   Schrijver [2003]: Combinatorial Optimization: Polyhedra and Efficiency; Sections 43.4 and 43.5, Corollary 43.2a

   (see also *Lovász [1980]: Selecting independent lines from a family of lines in a space.*)

3. **Linear matroid matching algorithm**

   Schrijver [2003]: Combinatorial Optimization: Polyhedra and Efficiency; Section 43.8

   (see also *Lovász [1980]: Matroid matching and some applications.*)

4. **Approximation algorithms** (PTAS for unweighted matroid matching, $\frac{3}{2}$-approximation for the matchoid problem)

   Lee, Sviridenko, Vondrák [2013]: Matroid matching: The power of local search; Sections 3 and 6

5. **LP relaxations** (lower bounds on the integrality gap)

   Lee, Sviridenko, Vondrák [2013]: Matroid matching: The power of local search; Section 4

6. **Weighted linear matroid parity algorithm: blossoms and dual feasibility**

   Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Sections 4 and 5

7. **Weighted linear matroid parity algorithm: optimality**

   Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Sections 2 and 6

8. **Weighted linear matroid parity algorithm: search for an augmenting path (I)**

   Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Section 7

9. **Weighted linear matroid parity algorithm: search for an augmenting path (II)**

   Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Sections 8

10. **Weighted linear matroid parity algorithm: updating dual variables**

    Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Section 9

11. **Weighted linear matroid parity algorithm: augmentation**

    Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Section 10

12. **Complexity of the weighted linear matroid parity algorithm and applications of matroid parity** (in particular A-paths and Steiner trees)

    Iwata, Kobayashi [2018]: A Weighted Linear Matroid Parity Algorithm; Section 11

    Lovász, Plummer [1986]: Matching theory; Section 11: p. 425 and exercise 11.1.5

    (see also *Lovász [1980]: Matroid matching and some applications.*)

    Prömel, Steger [1998]: A new approximation algorithm for the Steiner tree problem with performance ratio 5/3.