Polyhedral combinatorics exam

February 2, 2019

1. Fourier-Motzkin elimination
2. Equivalence of polyhedral and generated cones
3. Boundedness of a linear program, weak duality, translation space, direction cone
4. Basic solutions (well-defined, role in linear programming)
5. Strong basic solutions (how many exists, optimality)
6. Characterisation of optimal solutions, Strong Duality Theorem
7. Faces of a polyhedron (characterisation, $\subseteq$-minimal faces)
8. Vertices of a polyhedron (characterisations, bounded polyhedron is a polytope)
9. Incidence matrices of bipartite graphs and digraphs are TU
10. Network matrices are TU
11. Integral polyhedrons with TU matrices and TU-version of Farkas lemma
12. Integer decomposition property
13. Uniform k-colouring of the columns of a TU matrix and the rounding property
14. Kőnig's theorem about bipartite graphs
15. Existence of k disjoint matchings of size l in a bipartite graph
16. Uniform colouring of the edges of a bipartite graph
17. Hoffman's theorem about feasible circulations, Maxflow-Mincut theorem
18. Gallai's theorem about feasible potentials, cheapest circulation
19. Directed Chinese Postman Problem
20. Existence of an integral solution of $Ax = b$ where A, b are integral
21. The characterisation of integral polyhedrons by Edmonds and Giles
22. TU matrix from a cross-free $\mathcal{F} \subseteq 2^V$ and $D = (V, A)$
23. The subflow polyhedron and its TDI representation
24. The orientation theorem of Nash-Williams
25. The Lucchesi-Younger theorem (about dijoins and dicuts)