Transshipment problems: simplex method and network optimization algorithms

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1 Topic

This project concerns a connection between subjects covered in 'Optimization in $\mathbb{R}^n$' (Linear and Integer Programming and the simplex method) and subjects covered in 'Optimization in Networks' (several strongly polynomial algorithms for network optimization problems). The assignment is to study the minimum cost $b$-transshipment problem, its (integer) linear programming formulation and the application of the simplex method to this particular LP. The goal is to see which well-known network optimization problems are special cases of this transshipment problem, and moreover to discover which (strongly polynomial) combinatorial network algorithms known for these special cases can be viewed as specialisations of the simplex method (by explicitly indicating which particular pivot rule in the simplex method yields the combinatorial algorithm in question).

2 Keywords

Linear and Integer Programming, LP dual, Total unimodular matrices, integer polyhedra, Simplex Method for LP, pivot rule, basis, (directed) graph, network, $b$-transshipment, max flow problem, min cost flow problem, circulation problem, maximum or perfect (bipartite) matching problem, shortest path problem, shortest spanning tree problem, (strongly) polynomial time algorithm.

3 Literature

See Optimization in Networks for most relevant network optimization algorithms (except minimum cost flow and minimum cost circulation), see Optimization in $\mathbb{R}^n$ for (integer) linear programming, the simplex method and related issues. Total unimodularity and transshipment problems are discussed by R. Pendavingh in his mastercourse Advanced Linear Programming (see slides week 7). See moreover chapters 10 to 12 of [2] for transshipment and flow/circulation problems and algorithms, [1] for linear and integer programming theory, total unimodularity and integral polyhedra.

References
