A primal-dual symmetric simplex method for network flow problems

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Abstract

We apply the simplex algorithm using the primal-dual symmetric pivoting rule proposed by Chen, Pardalos, and Saunders [1] to the minimum cost network flow problems. This pivoting rule maintains a pair of primal-dual feasible solutions. In fact, the original simplex algorithm [1] can be viewed as Lemke's method applied to linear programming problems.

We propose a new initialization scheme which does not create a dense column as the original algorithm does. Due to this initialization, we can naturally apply the simplex algorithm to the minimum cost network flow problems, and prove the pseudo-polynomial complexity of the algorithm. Furthermore, we show strongly polynomial complexity of the algorithm when applied to the shortest-path problems.

References

[1] H.-D. Chen, P. M. Pardalos, and M. A. Saunders "The Simplex Algorithm with a New Primal and Dual Pivot Rule", DIMACS technical report 93-39, 1993.