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Abstract

Multi-Commodity Contraflow Problem on Lossy Network with Asymmetric Transit times †

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Abstract: During the transmission of commodities from one place to another, there may be loss due to death, leakage, damage, or evaporation. To address this problem, each arc of the network contains a gain factor. The network is a lossy network with a gain factor of at most one on each arc. The generalized multi-commodity flow problem deals with routing several distinct goods from specific supply points to the corresponding demand points on an underlying network with minimum loss. The sum of all commodities on each arc does not exceed its capacity. Motivated by the uneven road condition of transportation network topology, we incorporate a contraflow approach with orientation-dependent transit times on arcs and introduce the generalized multi-commodity contraflow problem on a lossy network with orientation-dependent transit times. In general, the generalized dynamic multi-commodity contraflow problem is NP-hard. For a lossy network with a symmetric transit time on anti-parallel arcs, the problem is solved in pseudo-polynomial time. We extend the analytical solution with a symmetric transit time on anti-parallel arcs to asymmetric transit times and present algorithms that solve it within the same time-complexity.

Keywords: multi-commodity; contraflow; asymmetric transit times; lossy network

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