

The Two-Echelon Capacitated Vehicle Routing Problem

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In the *Two-Echelon Capacitated Vehicle Routing Problem* (2E-CVRP) the delivery to customers from a central depot uses intermediate depots, called *satellites*. The 2E-CVRP involves two levels of routing problems. The first level requires to design the routes for a vehicle fleet located at the depot to transport the customer demands to a subset of the satellites. The second level concerns the routing of a vehicle fleet located at the satellites to supply all customers from those satellites which have been supplied from the central depot. The objective is to minimize the total routing cost.

In this talk, we describe a new exact method for solving the 2E-CVRP based on a new mathematical formulation of the problem. The lower bounds produced by different bounding procedures, based on *ng*-path relaxation and dual ascent methods, are used by an algorithm that decomposes the 2E-CVRP into a limited set of subproblems.

Computational results on benchmark instances from the literature show the effectiveness of the proposed method.

Key words: Two-Echelon vehicle routing, dual ascent, dynamic programming.