An exact approach for the consistent vehicle routing problem (ConVRP)

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ABSTRACT

This paper proposes a mathematical model for the Consistent Vehicle Routing Problem (ConVRP). The ConVRP is an extension of the VRP, considering customer satisfaction through consistent service. The consistency may be based on time or on the vehicle that offers the service. This paper proposes a novel mathematical model that allows solving the ConVRP for several companies for which visits to the customers need to be from the same service provider (namely, the same vehicle and driver). The efficiency of the model is tested on structured instances by changing customer distribution (uniform or clustered), depot location, and arrival time to the customer and removing certain constraints to see if they affect the performance of the objective function. The mathematical model is flexible and could be adapted to any characteristic of instances. The model was developed in the AMPL programming language and solved with the solvers CPLEX and Gurobi. The results are promising based on the efficiency of the proposed method at solving the problem.

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Natančen pristop za problem doslednega usmerjanja vozil (ConVRP)

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POVZETEK

V prispevku je predlagan matematični model za problem konsistentnega usmerjanja vozil (ConVRP). ConVRP je razširitev VRP, ki upošteva zadovoljstvo strank z doslednimi storitvami. Doslednost lahko temelji na času ali na vozilu, ki ponuja storitev. V prispevku je predlagan nov matematični model, ki omogoča reševanje ConVRP za več podjetij, pri katerih morajo biti obiski strank opravljeni s strani istega ponudnika storitev (istega vozila in voznika). Učinkovitost modela je bila preizkušena na strukturiranih primerih s spreminjanjem porazdelitve kupcev (enakomerne ali gručaste), lokacije skladišča in časa prihoda do stranke ter z odstranjevanjem nekaterih omejitev, da se ugotovi, ali le-te vplivajo na rezultat ciljne funkcije. Matematični model je prilagodljiv in ga je mogoče prikriti na kateri koli karakteristični primer. Model je bil razvit v programskem jeziku AMPL in rešen z reševalnikoma CPLEX in Gurobi. Glede na učinkovitost predlagane metode pri reševanju težave so rezultati obetavni.

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PODATKI O ČLANKU

Ključne besede:

Problem usmerjanja vozil (VRP);
Konsistentno usmerjanje vozil (ConVRP);
Matematični model;
Mešani celoštevilski model linearnega programiranja;
Optimizacija;
Natančni algoritmi;
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