



Variable neighborhood search algorithms for pickup and delivery problems with loading constraints

Telmo Pinto Cláudio Alves José Valério de Carvalho

Departamento de Produção e Sistemas, Escola de Engenharia, Universidade do Minho, 4710-057 Braga, Portugal

Abstract

In this paper, we explore a capacitated vehicle routing problem with loading constraints and mixed linehauls and backhauls. The problem belongs to the subclass of pickup and delivery problems. To solve this problem, we describe a set of variable neighborhood search approaches whose shaking and local search phases rely on different neighborhood structures. Some of these structures were specially developed for this problem. All the strategies were implemented and exhaustively tested. The results of this computational study are discussed at the end of this paper.

Keywords: Routing, loading constraints, backhauls, variable neighborhood search.

1 Introduction

The Vehicle Routing Problem with Mixed Linehauls and Backhauls (VRPMB) consists in a vehicle routing problem in which the set of customers is divided

* Supported by FEDER funding through the Programa Operacional Factores de Competitividade COMPETE and through the Portuguese Science and Technology Foundation (FCT): project UID/CEC/00319/2013 and grant SFRH/BD/73584/2010.

in two distinct sets: the set of linehaul and the set of backhaul customers. The former are characterized by a demand for a given product, while the latter supply quantities of this product. The transportation of loads can be only performed from or to the depot. Additionally, customers can be visited indistinctly, which means that backhaul customers can be visited before or between the visits of the linehaul customers. Some of the solution methods for the VRPMB are based on insertion heuristics [2,9]. Generally, these heuristics start by obtaining a solution for the vehicle routing problem only for linehaul customers. Then, each backhaul customer is assigned to the route point aiming to minimize the associated insertion cost.

The VRPMB belongs to the Pickup and Delivery Problems (PDP). There are very few approaches for PDP with 2- or 3-dimensional items. In [6], 2-dimensional items are considered. Sequential constraints are imposed, which mean that unloading an item must be performed in a straight move, without moving other items. Considering the 3-dimensional case, a PDP with loading constraints is addressed in [1]. No sequential constraints are considered.

In this paper, we address a VRPMB with 2-dimensional loading constraints (2L-CVRPMB). Generally, this problem corresponds to the integration of vehicle routing problem with 2-dimensional bin packing problem [5,3], in which customers are divided into backhaul and linehaul customers. To the best of our knowledge, there is only one approach for this problem [8], which addresses an insertion heuristic for the problem.

This paper is organized as follows. In Section 2, we describe the problem tackled in this paper. The neighborhood structures and the variants of the variable neighborhood search algorithm are presented in Sections 3 and 4, respectively. In Section 5 the computational results of this approach are presented and discussed. Finally, some conclusions are drawn in Section 6.

2 Problem Definition

The (2L-CVRPMB) is defined on a complete graph whose nodes represent the customers and the depot. The set of customers results from the junction between the set of l linehaul customers and the set of b backhaul customers. There is also a homogeneous fleet, and each vehicle has a weight capacity and a two-dimensional loading area with limited height and width. Each linehaul customer has a demand composed of 2-dimensional items, and each backhaul customer provides a supply composed of 2-dimensional items. The 2L-CVRPMB consists in finding the set S of optimal routes in order to visit all the customers exactly once, while satisfying all the capacity constraints

Download English Version:

<https://daneshyari.com/en/article/5777262>

Download Persian Version:

<https://daneshyari.com/article/5777262>

[Daneshyari.com](https://daneshyari.com)