Chapter 6
An Application for Routing Ambulance via ACO in Home Healthcare

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ABSTRACT

In this study, rovers of ambulances were identified and determined quickly and practically via ant colony optimization. Non-intuitive methods can also be used to determine the routing, but when the number of nodes is large, and the number of operations is very large, the heuristic methods are more practical. The purpose of this work is to use ant colony optimization via C# for ambulance routing. The patients were served as soon as possible thanks to ambulance routing. In this the effectiveness of the ambulance has been increased. In this study, 12 nodes were selected as an application. The nodes were used to determine the route of the ambulance in-home health care.

INTRODUCTION

Home health care is growing in the French medical sector since demands increase. Organizations providing home care services are willing to optimize their activities in order to meet the increasing demand for home care. Consequently, research on this problem has appeared by the end of the 20th century. Most of the work being

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application-based, the number of publications rises to cover the different variants of the problem. The problem is complicated by factors such as caregivers qualification, various patients demand, multiple home care offices, caregivers workload limitation, shared visits, patients availability and workload fairness among caregivers (Decerle et.al., 2017, Bertrand, 2010).

Home Health Care is a wide range of health care services that can be given in one's home for an illness or injury. In recent years, the health care industry has become one of the largest sectors of the economy in developed countries such as France, Germany, Australia, etc. Since the transportation cost is one of the most important spendings in the company activities, it is of great significance to optimize the vehicle routing problem in home health care company. According to a survey (Mankowska et al., 2014; Harris, 2015; Liu et al., 2013) of the home health care companies, each day, an HHC company carries out various logistics activities including the delivery of drugs or medical instruments from the pharmacy to patients, and pickup of the biological samples and waste from patients' home to the laboratory. A large number of patients are located in a town or village, and the task of a home health care company is to provide health care services to the patients at ones' homes one by one. The main operational process of the HHC can be summarized as three steps (Shi et al., 2017, p. 13987):

1. The HHC company collects information from the patients, this information may include: name, address, sex, type of the illness, symptom and other related information;
2. The HHC company plan to arrange the visited routes and assign nurses according to the information collected;
3. The nurses are scheduled to visit the patients. Each nurse is assigned to a planned route, and he/she has to carry out all of the service-related activities for the route. This nurse will drive the vehicle to visit the patients one by one according to the designed route.

Among the first papers about home health care, Begur et al. (1997) described a decision support system not taking into account time window and shared visits in opposite to Cheng and Rich (1998) who considered patients and care givers time window as well as multiple home care offices. They solved small instances with exact and heuristic approaches. Shared visits have been lately studied in the literature. Eveborn et al. (2006) developed a decision support system for an application in Sweden including shared visits who have also been studied by Rasmussen et al. (2012) using a branch-and-price algorithm or by Mankowska et al. (2014) using an adaptive variable neighborhood search algorithm as solving approaches (Decerle, 2017, p. 14662).