CHAPTER 1

INTRODUCTION

The facility location problem is the famous problem, which many researchers have paid attention for several years. Since 1973, many different cases of the facility location problems have been studied by many researchers and many methods have been proposed to solve the problems. The applications of facility location problem are widely spread among distribution systems, telecommunications networks, airline networks, pipeline systems, power transmission networks and transportation industries. The classification of facility location problem can be divided into several categories depend on assumed restrictions. One of the most well known problems of facility location problem is the single-source capacitated facility location problem (SSCFLP). This kind of problem is a special case of capacitated facility location problem in which each customer can only be supplied from exactly one facility. The problem is to find where and how many facilities must be opened and which customer should be assigned to each opened facility in which the total costs of establishing facilities, cost of assigning customer and the uncover demand cost are minimized when the demand of customer can be satisfied without violating the capacity constraints of the facilities.

Over the years, many effective solutions have been proposed for solving the single-source capacitated facility location problems. Both of exact and heuristic algorithms have been studied such as Branch and Bound (B&B), Lagrangean relaxation, Simulated Annealing (SA), etc. In this thesis, Ant Colony Optimization (ACO) has been proposed to solve the model. ACO has been proposed since 1990, and applications of ACO are spread on the wide areas such as Traveling Salesman Problem (TSP), Quadratic Assignment Problem (QAP), Scheduling Assignment Problem (SAP), Generalized Assignment Problem (GAP), and so forth. It has been observed that, Ant colony optimization has never been studied on the single-source capacitated facility location problem (SSCFLP). Nevertheless, ant colony optimization has been applied to generalized assignment problem (GAP), in which some characteristics are similar to the SSCFLP. Therefore, in this thesis, ant colony optimization (ACO) has been proposed to apply for a SSCFLP based on the concept of applying ACO on generalized assignment problem.

The performance of the proposed method has been evaluated under many situations and compared the results with an optimal solution and a well known heuristic approach that is Simulated Annealing (SA).

1.1 Problem Statement

A single-source capacitated facility location problem (SSCFLP) is a problem which study about where and how many facilities must be opened and which customer should be assigned to each opened facility in such a way that the total cost is minimized given a set of potential facilities and a set of demand customers. These proposed model concerns between the relationship of facilities and customers. The total costs consists of cost of establishing facilities, cost of assigning customer or transportation cost (depend on the

distance between facility and customer and amount of trips in transporting goods to customers) and uncover demand cost. The proposed model considers a capacity of each facility as constraint, each customer can only be supplied from only one facility and if a customer cannot be supplied from any facilities, the penalty cost will be calculated in term of uncover demand cost which result in the higher total cost.

1.2 Objective of the Thesis

This research aims to develop a model for determining where and how many facilities must be opened and which customer should be assigned to each opened facility in which the total cost should be minimized. This model has been analyzed under capacity constraint and also has been included uncover demand cost into the objective function as a penalty cost. Furthermore, an effective method, which is ant colony optimization (ACO), has been proposed to solve the model. This method has shown an efficient solution within a reasonable calculation time for giving the solution.

1.3 Overview of the Thesis

This thesis consists of six chapters. The first chapter deals with the introduction. It includes problem statement, objective of the thesis and overview of the thesis. Chapter two deals with literature review. The review describes the facility location problem and also explains two categories of the facility location problem, capacitated facility location problem and uncapacitated facility location problem. Next, chapter three explains the method of approach and the characteristic of the problem. Chapter four describes the characteristic of a proposed model and also explains how to apply the concept of Ant Colony Optimization (ACO) to solve the problem. Chapter five deals with another algorithm approach which has been constructed to compare the result with the proposed algorithm. The conclusion and recommendation for further study are finally presented in Chapter seven.