

Application of Genetic algorithm in solution of uncapacitated multi-period single allocation p-hub median problem.

Hamid Rastegar, Masoud Rabbani, Hooman Madani Saatchi

MSc student, School of Industrial Engineering, college of Engineering, University of Tehran, Tehran-Iran.
Email: Hamidrastegar93@ut.ac.ir

Professor, School of Industrial Engineering, college of Engineering, University of Tehran, Tehran-Iran.
Email: Mrabani@ut.ac.ir

MSc student, School of Industrial Engineering, college of Engineering University of Tehran, Tehran-Iran.
Email: HoomanMadani@ut.ac.ir

Abstract

Allocation p-hub median design problems play an important role in many real-life network systems such as transportation and telecommunication networks. It seeks to simultaneously determine the location of p hubs between n nodes and the optimized design of the network facilities in order to connecting an efficient hub and spoke network that minimizes the flow-weighted costs across the network. This paper is focused on uncapacitated single allocation multi-period p-hub median problem (UCSApHMP), which arises in many real-worlds hub networks of logistics operations. Instead of classical models, this paper assumed that there is a budget constraint in project and it leads the problem to be multi-period. We here in use a genetic algorithm determine location of hubs and optimal allocation of remained nodes to these hubs. The simulation results show that the proposed method can be considered as an efficient and robust method.

Keywords; Allocation, p-hub median problem, optimized design, Genetic algorithm, multi-period design.

1. Introduction

1.1 Hub location problems

Hubs are useful facilities that act as transshipment, sorting and switching in distribution systems. Instead of connecting each origin-destination points directly, in hub networks, flows send from origins to hubs and then from these hubs to destination. In this way, network takes advantage of economies of scale. In the other words, Flows from the same origin with different destinations are merged on their rout to the hub and are combined with flows that have different origins but the same destination. Since the transportation rate is smaller between hubs, using hubs can reduce the transportation cost in network. Hub networks are used in transportation and telecommunications systems such as airline, postal delivery systems, computer networks, etc. In hub location problems there are some assumptions in order to facilitate problem. 1. There is a complete hub network with a link between every hub pair. 2. There is an economy of scale by a factor of α using for the inter-hub connections and the third assumption is that no direct connection between non-hubs is allocated. In network hub location problems there is a network with n nodes on which the set of origins, destinations and potential hub locations are identified. There are some data given in problems such as the flow between origin-destination pairs and the hub to hub transportation discount factor α . hub location problems deals with the location of hubs and assigning of non-hub nodes to located hubs. Some papers just concentrate on allocation problems, but since optimal allocation is affected by good location and vice versa, allocation and location should be attended simultaneously. (S.Alumur, B.Kara, 2008). There are several kinds of hub location problems based on characteristics of a particular hub network. If the number of hub nodes is fixed to P, we are facing with p-hub location problems. There are two main types of hub networks which are single allocation and multiple allocations. They differ in how non-hub nodes are allocated to hubs. In single allocation, each