

A Web-Based Decision Support System for the Capacitated Facility Location Problem

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EXTENDED ABSTRACT

The facility location problem is a widely studied classical operations research problem and has practical applications in many different fields; in the distribution and transportation industries among others. In facility location-allocation models, enterprises are concerned with finding the best location to install their new facilities from a given set of potential sites; another set consists of existing and already established facilities with known locations. The main aim of the new enterprises is to obtain the largest possible share and revenue from this specific market and on the same time to avoid any overlapping between the market segments that they will serve.

The problem has been studied extensively in the international bibliography; the literature contains a wide range of proposed algorithms, variants and extensions. In this paper, we consider a particular type of the facility location problem, called the multiple capacitated facility location problem under time constraints. To outline the problem, a number of existing competitive enterprises, which produce certain products or services, operate in a specific market. The market requires a specific quantity of this product or a specific level of this service in a determined time period and the already existing enterprises cover the needs of the market to the greatest degree. A number of new cooperating enterprises

attempt to enter the market and seek the best locations from a number of available candidate locations. The new enterprises seek to acquire the largest possible share of this market and avoid any overlapping between the market segments served. Hence, the locations of these entering enterprises must ensure their economic viability. Each new enterprise ideally should occupy an adequate share of the market, so that its production is higher than a determined sales threshold level. In other words, the enterprises aim to ensure their economical viability in order to make such an investment. The market surface can be simulated by a network with existing facilities nodes, demand nodes and candidate nodes.

To address this problem we propose an algorithm that calculates the exact solution for a given multiple capacitated facility location problem so long as that exists. Many issues of this problem belong to the NP-hard class of algorithms and as a result the computation time is disappointing for large networks. Therefore, we present a dynamic approximation algorithm for the solution of this problem that is capable to compute an approximation solution in an acceptable time interval.

Only few software packages exist exclusively for the solution of this problem. In the present paper, a web-based decision support system (DSS) for the multiple capacitated facility location problem is presented. The proposed algorithms have been implemented with MATLAB R2012b and converted to Java classes using the MATLAB Builder JA. The web interface of the DSS has been designed using Java and multiple users can access it through a web browser.

The DSS offers the possibility to create either a random or a custom graph. The custom graph is inserted from a valid Microsoft Excel or text file. After the creation of the market's network, users can evaluate both algorithms by performing alternative scenarios for the future development of the market. Finally, the DSS can export the results of the evaluation, including tables and animated diagrams to a Microsoft Word document for further use.

Keywords: Decision support systems, capacitated facility location problem, location allocation problem