A BI-OBJECTIVE UNCAPACITATED FACILITY LOCATION PROBLEM

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ABSTRACT: We consider a bi-objective model for uncapacitated facility location where one objective is to maximize the net profit and the other to maximize the profitability of the investment. Facility location problems have been extensively studied during the past two decades. The typical objective in most facility location models, especially those in the private sector, is to maximize the profit which is calculated by subtracting the total cost from the total revenue. Provided that demands are fully satisfied, this objective is the same as cost minimization. In these models, costs include a fixed charge for establishing each facility and the variable costs associated with production and transportation. Usually, the fixed cost means an investment of a single cash outlay at the initial time period, whereas the revenue and the variable costs occur periodically in a stream-like manner. Therefore, the cash flows differing in their temporal occurrences should be adjusted to the same base period using the discount factor. The objective of profit maximization, though the most widely used decision criterion in business decision-making environments, is not necessarily the best one. In reality, investment decisions are often based not so much on the absolute size of the profit as on the profitability of each investment alternative. Particularly under a limited budget for investments, the profitability of each investment is the main factor to take into account in selecting the most desirable one. The profitability of an investment is usually measured by the ratio of the level of the profit gained to the size of the investment, which is referred to as the profitability index, or the rate of return. The objective of maximizing profit may conflict with the one of maximizing profitability, since the marginal return on an investment generally decreases as its size increases. Here, we consider a bi-objective uncapacitated facility location problem (BUFLP). The problem is to select the location of uncapacitated facilities in such a way as (i) to maximize the profit and (ii) to maximize the profitability of the total investment. We first characterize the structure of the model having both a linear and a fractional objective function. In order to generate efficient solutions for the model, we develop a heuristic procedure which has computational advantages over existing methods. A numerical example is presented to illustrate the solution process and computational tests on large scale problems are also provided.