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A MULTI-DIMENSIONALIZATION OF COMPETITIVE FACILITY LOCATION PROBLEMS

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Abstract. *There are many researches for location problems of competitive facilities, e.g., shops and stores, on a line segment or a plane. For applying these studies to other various decision makings, this paper considers competitive facility location problems on multi-dimensional spaces. In order to solve the formulated problem efficiently, first, it is shown that one of its optimal solutions can be found by solving a 0-1 programming problem, next, its efficient solution method is proposed based upon the tabu search algorithm with strategic oscillation. The efficiency of the solution method is shown by applying it to some numerical examples of the multi-dimensional competitive facility location problem.*
Keywords: Location, Competitiveness, Multi-dimensional space, Tabu search, Strategic oscillation

1. **Introduction.** Competitive facility location problem (CFLP) is one of optimal location problems for commercial facilities, e.g., shops and stores, and the objective of a decision maker (DM) for the CFLP is mainly to obtain as many demands for her/his facilities as possible. Mathematical studies on CFLPs are originated by Hotelling [1]. He considered the CFLP under the conditions that (i) customers are uniformly distributed on a line segment, (ii) each of DMs can locate and move her/his own facility at any times, and (iii) all customers only use the nearest facility. As an extension of Hotelling's CFLP, CFLPs on a plane were studied by Okabe and Suzuki [2], and recently Cabrera et al. [3] applied Hotelling's CFLP to retail stores location. Wendell and McKelvey [4] assumed that there exist customers on a finite number of points, called demand points (DPs), and they considered the CFLP on a network whose nodes are DPs.

Based upon the CFLP proposed by Wendell and McKelvey, Hakimi [5] considered CFLPs under the conditions that the DM locates her/his facilities on a network where other competitive facilities were already located. Drezner [6] extended Hakimi's CFLPs to the CFLP on a plane that there are DPs and competitive facilities. For solving Drezner's CFLP efficiently, Uno et al. [7] proposed an evolutionary multi-agent based search method.

In the above CFLPs, customers choose their facilities by estimating only the distance between them and facilities. Huff [8] defined the attractive function of a facility for