Three Types of Competitive Facility Location Problems
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In competitive facility location (CFL) problems, a firm is concerned with installing new facilities to serve customers in a market where existing facilities with known locations and attractiveness levels compete for increasing their market share and profit. We can classify the CFL problems into two groups: those with non-reactive competition and those with reactive competition. In all the three types models we consider, the objective of the new entrant firm is to determine the locations and attractiveness levels of the new facilities to maximize the profit.

The first type CFL problem belongs to the class of problems with non-reactive competition. We formulate a mixed-integer nonlinear programming model for this problem and propose three methods for its solution: a Lagrangean heuristic, a branch-and-bound method with Lagrangean relaxation, and another branch-and-bound method with nonlinear programming relaxation. We consider next an extension on the first type CFL problem by relaxing the assumption that the competitor in the market does not react to the opening of the new facilities. In this second type model, the competitor can react by adjusting the attractiveness levels of its existing facilities with the objective of maximizing its own profit. To this end, a bilevel mixed-integer nonlinear programming model is formulated. In order to find the optimal solution, we convert it into an equivalent one-level mixed-integer nonlinear program so that it can be solved by a global optimization method. The last CFL model relaxes the limitation about the competitor’s reaction such that the competitor can react by opening new facilities, closing existing ones and/or adjusting the attractiveness levels. A more complex bilevel mixed-integer nonlinear programming model is proposed whose solution is obtained by heuristics that combine tabu search with exact solution methods.