The Min-Max Close-Enough Arc Routing Problem

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Traditionally, arc routing problems consist of finding one or several routes traversing a given set of arcs and/or edges that must be serviced. The Close-Enough Arc Routing Problem, does not assume that customers are located at specific arcs, but can be serviced by traversing any arc of a given subset. This problem has real-life applications as routing for automated meter reading or inventory management. The idea is that if a device with a radiofrequency reciever gets within a certain distance of a meter or a tag, it collects its data. Therefore, only a few streets/aisles which are close enough to the meters/tags need to be traversed. In this work we introduce a generalization of this problem, the Min-Max Close-Enough Arc Routing Problem. In particular, we consider a CEARP in which a fleet of vehicles must serve the set of customers while trying to balance the length of the routes, i.e., minimizing the length of the largest route.

We present two formulations of the problem; the first one is the traditional arc-based formulation making use of arc and servicing variables, and the second one a route-based set covering formulation. Based on the respective formulations, we designed and implemented a branch-and-cut and a branch-and-price algorithm. A heuristic algorithm used to provide good upper bounds to the exact procedures is also presented. Extensive computational experiments to compare the performance of the algorithms are carried out.