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The Maximal Dispersion Territory Design Problem and the WEEE-directive

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Abstract

Territory design is the problem of grouping small geographic areas called basic areas (e.g., counties, zip code areas) into larger geographic clusters called territories such that the latter fulfil relevant planning criteria. These criteria can either be economically motivated (e.g., average sales potentials, workload or number of customers) or have a demographic background (e.g., number of inhabitants, voting population). Moreover, spatial restrictions are often demanded. The problem we discuss is motivated by the new recycling directive WEEE of the EC. The core of this law is, that each company which sells electronic products in a European country has the obligation to recollect and recycle an amount of returned items which is proportional to the market share of the company. In Germany, for one type of products, the so called white goods (e.g., dry-cleaners, washing machines, fridges), a territory design approach is followed. However, as the EC wants to avoid that a recycling corporation gains a monopoly in some region of Germany, all basic areas which are allocated to the same corporation should be geographically as dispersed as possible. That is, one of the classical criteria for territory design problems, compactness, is completely inverted. For this problem, we first review the initial mathematical programming model. Afterward, we introduce improvements of the model which include strategies for fixing variables as well as valid inequalities. Moreover, we discuss a simplified version of the problem which allows us to obtain tight and easy to compute bounds for the original problem. Finally, computational results will be presented that underline the model improvements.