Pareto-Optimality of the Balinski Cut for the Uncapacitated Facility Location Problem

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Abstract—The classical 1962 Benders decomposition scheme is a traditional approach for solving mixed-integer problems such as the uncapacitated facility location problem. Subsequent research has been focused on finding better cutting-plane generation schemes to reduce the solution process time. Pareto-optimal cuts are typically preferred because no other cut can dominate them. However, the Pareto-optimal cut generation process typically requires running a separate linear program at each iteration to determine the appropriate dual variables. It is proven here that the dual variable selection scheme proposed in 1965 by Balinski will generate cuts that are always Pareto-optimal for the uncapacitated facility location problem and can be easily generated without running a time-consuming second linear program at each iteration. Direct comparisons between Benders cuts and Balinski cuts for 25 classical problems from the literature provided an empirical indication of the relative advantage of employing Balinski cuts.

Keywords—Integer programming, Facility location, Decomposition, Cutting planes, Facet generation

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