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Block-Structured Integer and Linear Programming in Near Linear Time

We consider *integer* and *linear programming* problems for which the linear constraints exhibit a block-structure: The problem decomposes into independent small subproblems if a few constraints are deleted.

For linear programming, our algorithm relies on the *parametric search* framework by Norton, Plotkin, and Tardos in combination with Megiddo's multidimensional search technique. This also forms a subroutine for integer programming. We use a strong linear relaxation and present a *proximity bound* between the respective optima that is independent of the dimension.

We apply our results to n-fold integer programs, obtaining algorithms that are near-linear in the dimension and strongly polynomial.