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A Note on Piecewise Affine Decision Rules for Robust, Stochastic, and Data-Driven Optimization

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Multi-stage decision-making under uncertainty, where decisions are taken under sequentially revealing uncertain problem parameters, is often essential to faithfully model managerial problems. Given the significant computational challenges involved, these problems are typically solved approximately. This short note introduces an algorithmic framework that revisits a popular approximation scheme for multi-stage stochastic programs by Georghiou et al. (2015) and improves upon it to deliver superior policies in the stochastic setting, as well as extend its applicability to robust optimization and a contemporary Wasserstein-based data-driven setting. We demonstrate how the policies of our framework can be computed efficiently, and we present numerical experiments that highlight the benefits of our method.

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