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Altruistic Kidney Exchange

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Abstract

Although a national live-donor kidney exchange program is being launched in the US, the kidney shortage is increasing faster than ever. A new solution paradigm is able to incorporate compatible pairs in exchange. In this paper, we consider an exchange framework that has both compatible and incompatible pairs, and patients are indi erent over compatible pairs. Only two-way exchanges are permitted due to institutional constraints. We explore the structure of Pareto-effi cient matchings in this framework. The mathematical structure of this model turns out to be quite novel. We show that all Pareto-e fficient matchings match the same number of patients, and it is possible to construct Pareto-e fficient matchings that match the same incompatible pairs while matching the least number of compatible pairs. We non-trivially extend the famous Gallai-Edmonds Decomposition in the combinatorial optimization literature to our new framework.

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ABSTRACT

Although a national live-donor kidney exchange program is being launched in the US, the kidney shortage is increasing faster than ever. A new solution paradigm is able to incorporate *compatible pairs* in exchange. In this paper, we consider an exchange framework that has both compatible and incompatible pairs, and patients are indifferent over compatible pairs. Only two-way exchanges are permitted due to institutional constraints. We explore the structure of Pareto-efficient matchings in this framework. The mathematical structure of this model turns out to be quite novel. We show that under Pareto-efficient matchings, the same number of patients receive transplants, and it is possible to construct Pareto-efficient matchings that match the same incompatible pairs while matching the least number of compatible pairs. We non-trivially extend the famous Gallai-Edmonds Decomposition in the combinatorial optimization literature to our new framework.

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