# Determining the Effectiveness of an Optimization Matching in Kidney Paired Donation Using Graph Theory

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Annually, 5000 kidney disease patients die while waiting for a kidney transplant match. The purpose of this experiment is to decrease this number by determining the efficiency of the optimization matching method in paired kidney. A paired kidney exchange is between two donor recipient pairs, so Patient 1 receives a kidney from Donor 2, and Patient 2 from Donor 1. It was hypothesized that applying an optimization model to a database of kidney pairs would result in a higher number of matches found than when using first acceptance matching, the method used in hospitals currently. Both methods were tested on ten databases of 50 pairs each. Five databases had only incompatible donor recipient pairs; the remaining five had both compatible and incompatible pairs. The optimization method consistently gave a significantly higher number of matches than the first acceptance method, with an average of 16 matches found out of a possible 25. Optimization on databases with both compatible and incompatible pairs had a 94% success rate in finding matches, compared to the 24% success rate of first acceptance matching on databases with incompatible pairs only. Therefore it is concluded that optimization is quite effective in kidney matching. The experiment can be further developed to include specific constraints such as tissue type, age, or cost. Findings of this experiment show enormous scope for the development of the optimization matching scheme to save many lives and millions of dollars.

**Awards Won:**