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A Discrete Optimization Model to Minimize Organ Recovery Time Using Heuristic Algorithms

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Abstract: This study proposes a discrete optimization model to minimize the organ recovery time in an Organ Procurement Organization (OPO) by grouping its associated hospitals and transplant centers into several clusters, based on their available organ recovery groups. Typically, the OPO covers a relatively large geographical area to recover organs from donors and deliver them to the recipients. Organs and/or tissues need to be transplanted within their viable time. Therefore, a discrete optimization model is proposed, based on the p-median approach to identify optimal locations of the organ recovery groups to recover the organs within a desired time interval. Three heuristic solution approaches, such as Multi-start Fast Interchange (MFI), Simulated Annealing (SA), and Lagrangian Relaxation Algorithm (LRA), are applied to solve the p-median clustering problems. Numerical examples are tested to identify a better solution approach in terms of a set of Key Performance Indicators (KPI), such as elapse time, Silhoutte index, and objective function value. The experimental results indicate that the MFI approach is effective to find an initial solution in the shortest possible time. To find a non-dominant optimal solution, the LRA is outperformed from the initial solution. In the future, the experimental results will be compared with real data to ensure the effectiveness of the proposed model.

Keywords: p-median, Multi-start fast interchange, Simulated annealing, Lagrangian relaxation