

Branch-and-Cut-and-Price for the Pickup and Delivery Problem with Time Windows

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In the pickup and delivery problem with time windows (PDPTW), vehicle routes must be designed to satisfy a set of transportation requests, each involving a pickup and a delivery location, under capacity, time window, and precedence constraints. The PDPTW has applications in various contexts such as urban courier services, less-than-truckload transportation, and door-to-door transportation services for the elderly and the disabled. This talk presents a new branch-and-cut-and-price algorithm in which lower bounds are computed by solving through column generation the linear programming relaxation of a set partitioning formulation. Two pricing subproblems are considered in the column generation algorithm: an elementary and a non-elementary shortest path problem. We also explain how valid inequalities can be added dynamically during the solution process to strengthen the relaxations. Finally, we show that some of the existing valid inequalities for the PDPTW are implied by the set partitioning formulations.