A Strong Cutting Plane Algorithm for the Selection Problem with a Resource Constraint

박 경철, 박 성수

한국과학기술원 산업공학과

ABSTRACT

We consider the selection problem with a resource constraint where the required sets of activities for the projects are not mutually exclusive. The problem can be viewed as a generalized knapsack problem and appears in several applications including the capital budgeting problem, FMS production planning problem and database design problem. We formulate the problem as the nonlinear knapsack problem with polynomial objective function. After linearinzing the nonlinear terms, we analyze the polyhedral structure of the related polytope. We propose some classes of valid ineqaulties and two efficient lifting procedures. Additionally, we show that the proposed inequalities are sufficient to cut off all the fractional vertices of the natural linear programming relaxation. Using the polyhedral results, we propose an LP-based cutting plane algorithm and test the algorithm on several sets of test problems. The computational results show that the algorithm can be used to solve practical problems optimally in reasonable time. The results developed in this research can be generalized to the cases where more than one resource constraints are needed.