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An Algorithm for Approximating High-Order Pareto Frontier in Multiobjective Integer Linear Problems

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An algorithm for approximating the Pareto frontier (PF) in multiobjective integer linear problems is presented. As known, the feasible set in the objective space (FSOS) for an integer linear programming problem is not convex and only a few points of its Pareto frontier (so called supported points) can be found when constructing its convex hull. To get these points at the fisrt iteration of our algorithm we construct the convex Edgeworth-Pareto hull (CEPH) of the FSOC, i.e. a broader convex set that has the same Pareto frontier.

The algorithm for constructing CEPH is more simple then one for constructing convex hull. It gives the result in the form of both a set of vertices and a system of linear inequalities. Using this information we can specify an unexplored region in the objective space which contains all not found yet Pareto frontier's points. This region is restricted by the CEPH's Pareto frontier and the Pareto frontier of the union of cones dominated by corresponding CEPH's vertices. It can be easily vizualized on computer display.

At each iteration, one unexplored subregion is selected to construct its partial CEPH. To formulate this subproblem, vertices and hyperplanes of CEPHs calculated at the previous iterations are used. As a result, new PF's points for the initial problem can be found and the unexplored area is reduced.

The proposed algorithm can be apllied for approximating Pareto frontier in the criteria space till 4-5 dimensions. It can be useful for Decision Support Systems in such areas as forest planning and management, water resources management and etc.

References

Lotov A., Bushenkov V., Kamenev G. Interactive Decision Maps. Approximation and Visualization of Pareto Frontier. Kluwer Academic Publishers, 2004.

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