Extremal Problems in Tropical Mathematics: Solution Methods and Application to Location Analysis

Nikolai Krivulin
St. Petersburg State University, Russia

Tropical (idempotent) algebra, which deals with vector semimodules over idempotent semirings, finds expanding application as a promising modeling and solution tool in applied mathematics, computer science, and operations research. The progress in the area is mainly due to the fact that many complicated problems that are actually nonlinear in the ordinary sense become linear and so more tractable when translated into the language of the algebra. Among the topical lines of investigation is the development of methods and computational procedures for solution of extremal problems including idempotent analogues of linear programming problems and their extensions.

We consider multidimensional extremal problems that consist in minimization of functionals defined on semimodules over idempotent semifields. Closed-form solutions to the problems are given based on methods and techniques of solving linear vector equations as well as on extremal properties of eigenvalues of irreducible matrices in idempotent algebra. We show how to apply the results to solve both unconstrained and constrained multidimensional minimax single facility location problems with rectilinear and Chebyshev distances.