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Matthias Köppe* (mkoepp@math.ucdavis.edu), **Amitabh Basu**, **Robert Hildebrand** and **Marco Molinaro**. *The Gomory-Johnson infinite group problem: A 40-year update.*

I present new results on the Gomory-Johnson infinite group problem, which appear in joint papers with A. Basu, R. Hildebrand, M. Molinaro.

The infinite group problem is an infinite-dimensional abstraction of mixed-integer linear programs for the purpose of deriving cutting planes.

We give an algorithm for testing the extremality of minimal valid functions for the infinite group problem on R^1/Z^1 , that are piecewise linear (possibly discontinuous) with rational breakpoints. This is the first set of necessary and sufficient conditions, which can be tested algorithmically, for deciding extremality in this important class of valid minimal functions. We also present an interesting irrational function.

We also prove that any minimal valid function for the k -dimensional infinite group relaxation (on R^k/Z^k) that is piecewise linear with at most $k + 1$ slopes and does not factor through a linear map with non-trivial kernel is extreme. This generalizes the famous 2-slope theorem of Gomory and Johnson for $k = 1$, and a corresponding result by Cornuéjols and Molinaro for $k = 2$. (Received September 13, 2012)