

ON CALCULATING MINIMAL GENERATING SETS IN MAGMAS

MIKOLÁŠ JANOTA, ANTÓNIO MORGADO, AND PETR VOJTĚCHOVSKÝ

ABSTRACT. We present an algorithm for calculating a minimal generating set of a finite algebra. Despite the fact that the problem is in NP, a single call to a SAT solver is impractical since the encoding is cubic. Instead, the proposed algorithm solves a series of smaller subproblems in the spirit of counterexample-guided abstraction refinement. The individual subproblems are formulated as integer linear programs that are solved by an off-the-shelf solver. Our implementation shows that the proposed algorithm is highly efficient and is able to compute minimal generators for algebras of orders approximately 2000.

In our experiments we focus on Moufang loops, a variety of loops with properties close to groups. For Moufang loops of prime power order, we are able to calculate a minimal generating set by another method, using theoretical results on the Frattini subloop and algorithms for permutation groups, of which some are reported here for the first time. This second method does not cover all cases, but in the covered cases it serves as a check of correctness of the LP-based algorithm.

Mikoláš Janota; Czech Technical University
Email address: `mikolas.janota@cvut.cz`

António Morgado Universidade de Lisboa
Email address: `ajrmorgado@gmail.com`

Petr Vojtěchovský University of Denver
Email address: `petr@math.du.edu`

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