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Finding simple t-designs by using basis reduction.

Proceedings of the seventeenth Southeastern international conference on combinatorics, graph theory, and computing (Boca Raton, Fla., 1986).
Congr. Numer. **55** (1986), 235–244.

Summary: "In 1976, Kramer and Mesner observed that finding a t-design with a given automorphism group can be reduced to solving a matrix problem of the form $AX = M$, $X[i] = 0$ or 1, for all i, $1 \leq i \leq n$, where A is an $m \times n$ positive integer matrix built from the required automorphism group and M is a particular m-dimensional integer vector. This problem is NP-complete. We present an algorithm that searches for a solution when given an instance of this 0-1 matrix problem. This algorithm always halts in polynomial time but does not always find a solution when one exists. The problem is first converted to one of finding a particular short vector in a lattice and then uses a lattice basis reduction algorithm due to A. K. Lenstra, H. W. Lenstra, Jr. and L. Lovasz [Math. Ann. 261 (1982), no. 4, 515–534; MR 84a:12002] to attempt to find it. We apply this method to the search for simple t-designs with $t \geq 6$ and duplicate results of Leavitt, Kramer and Magliveras in substantially shorter time. Furthermore, a new simple 6-design was found using the algorithm described in this paper." *Luc Teirlinck* (1-ABRN-DS)