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Coloring Cayley tables

The chromatic number of a Latin square is defined as the minimum number of partial transversals needed to cover all of its cells. It has been conjectured that every Latin square L of order n satisfies $\chi(L) \leq n+2$. If true, this would resolve a longstanding conjecture of Brualdi and Stein that every Latin square has a near transversal. Restricting our attention to Cayley tables of finite groups, we prove two partial results. First, we construct $(n+2)$-colorings for all Abelian groups, showing that the conjecture holds in this special case. Second, we give an upper bound for $\chi(L)$ that depends only on the order of the underlying group. This improves the best-known general upper bound from $2n$ to $\frac{3}{2}n$, while yielding an even stronger result in infinitely many cases.