Additive Combinatorics
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Multidimensional zero-sum problems

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Abstract

For a finite Abelian group G let $\mathsf{s}(G)$ denote the smallest integer l such that every sequence S over G of length $|S| \geq l$ has a zero-sum subsequence of length $\exp(G)$. In particular, the case $G = C_n^r$ has attracted a great deal of attention. For example, Alon and Dubiner proved that for fixed r: $\mathsf{s}(C_n^r) \leq c_r n$ holds, and Meshulam proved $\mathsf{s}(C_3^r) = O(3^d/d)$.

We derive new upper and lower bounds for $\mathsf{s}(G)$ and all our bounds are sharp for special types of groups. In particular, we show $\mathsf{s}(C_n^4) \geq 20n - 19$ for all odd n which is sharp if n is a power of 3. Moreover, we investigate the relationship between extremal sequences and maximal caps in finite geometry.

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