

Structure of sumsets and applications

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Abstract

The fundamental “inverse” theorem of Freiman asserts that if A is a finite set of integers and $A+A$ is small, then A is a specific structure. We are going to discuss several variants of this theorem. For instance, instead of looking at $A+A$, we will look at $S(A)$, which is the collection of subset sums of A , and consider the following questions:

1. What can one say about A if $S(A)$ is “small” in some sense?
2. What can one say about A if $S(A)$ has a large multiple (i.e., there are many subsets of A with the same sum)?

The answers to these questions lead to progresses in some old problems, such as Erdős–Folkman conjecture concerning complete sequences and Littlewood–Offord problem concerning the concentration function. The latter has further applications in the theory of random matrices.