Nonnegative k-sums, Fractional Covers, and Probability of Small Deviations

Hao Huang, University of California-Los Angeles

Abstract

More than twenty years ago, Manickam, Miklós, and Singhi conjectured that for any integers n, k satisfying $n \geq 4k$, every set of n real numbers with nonnegative sum has at least $\binom{n-1}{k-1}$ k-element subsets whose sum is also nonnegative. In this talk we discuss the connection of this problem with matchings and fractional covers of hypergraphs, and with the question of estimating the probability that the sum of nonnegative independent random variables exceeds its expectation by a given amount. Using these connections together with some probabilistic techniques, we verify the conjecture for $n \geq 33k^2$. This substantially improves the best previously known exponential lower bound $n \geq e^{ck \log \log k}$.

This is joint work with Noga Alon and Benny Sudakov.