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Math 269 - Combinatorics

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Sets without 4APs but with many 3APs

Abstract:

It is a classical theorem of Roth that every dense subset of $\{1, \dots, N\}$ contains a nontrivial three-term arithmetic progression. Quantitatively, results of Sanders, Bloom, and Bloom-Sisask tell us that subsets of relative density at least $1/(\log N)^{1-\epsilon}$ already have this property. In this talk, we will discuss about some sets of N integers which unlike $\{1, \dots, N\}$ do not contain nontrivial four-term arithmetic progressions, but which still have the property that all of their subsets of density at least $1/(\log N)^{1-\epsilon}$ must contain a three-term arithmetic progression. Perhaps a bit surprisingly, these sets turn out not to have as many three-term progressions as one might be inclined to guess, so we will also address the question of how many three-term progressions can a four-term progression free set may have. Finally, we will also discuss about some related results over $\mathbb{F}_q^n$. Based on joint works with Jacob Fox and Oliver Roche-Newton.

Host: Andrew Suk

Thursday, November 21, 2019
3:00 PM
AP&M 6218

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