GEOMETRIC COMBINATORICS

IN DISCRETE SETTINGS

David Covert

Dr. Alex Iosevich, Dissertation Supervisor

ABSTRACT

This thesis is a compilation of work in which the author studies geometric config-
urations in finite fields and the integers modulo q. The results of this dissertation are
threefold. First, we prove a finite field analog of the Furstenberg-Katznelson-Weiss
theorem on triangles in $\mathbb{R}^2$. Second, we study volume sets in $\mathbb{F}_q^d$ and discuss some
applications to sum-product problems. Finally, we study geometric combinatorics in
$\mathbb{Z}/q\mathbb{Z}$. We generalize a result of Hart and Iosevich [27] which has applications to
sum-product problems. Finally, we show that the $\mathbb{Z}_q^d$ analogue of a sphere with unital
radius is q^{d-1}-dimensional.