

University of Delaware  
Discrete Mathematics Seminar

**Bounds on the size of sets with few distances**

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**Abstract**

Consider a subset  $(x_1, x_2, \dots, x_M)$  of  $\{0, 1\}^n$  such that for all  $i, j$  the Hamming distance  $d(x_i, x_j)$  is either  $a$  or  $b$  or  $c$  (or 0) for some fixed numbers  $a, b, c$ . How large can  $M$  be? This is an instance of a large group of problems in combinatorics and geometry that include the Frankl-Wilson bound on families of finite sets with restricted intersections, the Erdos-Ko-Rado theorem and its many extensions, the Delsarte-Goethals-Seidel bound for spherical codes, and so on.

We will introduce some of these problems and show the two main methods of proving the results. New results, obtained in a joint work with Oleg Musin ([arxiv:0905.2423](https://arxiv.org/abs/0905.2423)), include an improvement of the RayChaudhuri-Wilson bound on the size of uniform  $s$ -intersecting families and similar theorems. For small  $n$  we also find the exact size of maximal codes with 2, 3, and 4 distances.