Abstract

Arcs in Projective Geometries over $\mathrm{GF}(4)$ and Quaternary Linear Codes

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The problem of finding the shortest length $n_q(k, d)$ of a q-ary linear $[n, k, d]$-code with given dimension k and minimum distance d is a variant of the main coding theory problem. It has been studied extesively in the last thirty years. The problem has a clear geometric relevance since the existence of a linear $[n, k, d]_q$-code is equivalent to the existence of a $(n, n - d)$-arc in $\mathrm{PG}(k - 1, q)$. It is solved completely, i.e. for all values of d, in the following cases: $q = 2, k \leq 8$, $q = 3, k \leq 5$, $q = 4, k \leq 4$, and $q = 5, k \leq 3$.

In this talk, we give a characterization of some arcs in $\mathrm{PG}(3, 4)$. Their structure is used to rule out the existence of certain arcs in the geometry $\mathrm{PG}(4, 4)$. This in turn violates several Griesmer codes with $k = 5, q = 4$ and determines the exact values $n_4(5, d)$ for the corresponding d's. Finally, we survey the the state-of-the-art in the problem of finding the exact value of $n_4(5, d)$.