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 $n_4(5,d)$.