SPT(q, k, n)-codes

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The following was motivated by database research. We consider q-ary codes of length n with property

- $\mathcal{C}$ has minimum Hamming-distance at least $n - k + 1$.
- For any set of $k - 1$ coordinates there exist two codewords that agree exactly there.

A $k - 1$-set of coordinate can be considered as a 'direction', so in $\mathcal{C}$ the minimum distance is *attained in all directions*. Such a code $\mathcal{C}$ is called *sphere-packing type code* of parameters (q, k, n), or *SPT(q, k, n)-code* for short. For example, the rows of the $k+1 \times k+1$ identity matrix form an SPT($2, k, k+1$)-code.

Definition 1 *Let $q > 1$ and $k > 1$ be given natural numbers. Let $f(q, k)$ be the maximum n such that there exists an SPT(q, k, n)-code.*

New bounds on $f(q, k)$ are proven. Upper bound employs spherical codes, the lower bound is probabilistic construction using Lovász Local Lemma