Armstrong Codes

György Moskát

Supervisor: Dr. Attila Sali

Abstract

An Armstrong code $Arm(q, k, n)$ is a q-ary code of length n, such that for every subset of size k-1 coordinate positions there are two codewords that agree there, and for every subset of k coordinate positions there are no two codewords that agree there.

The largest n for which an $Arm(q, k, n)$ exists is denoted by $f(q, k)$. The thesis investigates what possible upper bounds can be given for $f(q, 4)$. In my bachelor thesis a construction for an $Arm(q, 4, 2q - 1)$ when $2q - 1$ is prime was presented, giving $2q - 1 \leq f(q, 4)$. The goal of the thesis is to investigate different methods from which upper bounds for $f(q, 4)$ can be achieved.

One possible way to obtain an upper bound for codes with given minimum distance is by Delsarte's linear programming bound for association schemes. Another way is by considering the Lovász θ function for the graph of a Hamming scheme. Armstrong codes can also be projected to the surface of the $(q - 1)n$ dimensional unit sphere and viewed as a packing of spherical caps.

After comparing the bounds given by the different methods $f(q, 4) < 3q + \sqrt{q}$ is obtained.