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Optimal Equidistant Codes–A Detective Story

An *equidistant code* $E(n, d, m)$ consists of m binary codewords of length n, such that the hamming distance between any two distinct codewords is exactly d. We study the following problem: (1) Given n (the length of the codewords), determine the maximum m such an $E(n, d, m)$ exists for some d. Denote this maximum value of m (which of course is a function of n) by m^*. (2) Determine the maximum d such that an $E(n, d, m^*)$ exists. Denote this maximum value of d (which is also a function of n) by d^*. (3) Give a strong combinatorial characterization (in terms of symmetric BIBDs) of $E(n, d^*, m^*)$.

Such optimal equidistant codes have been studied at least since the 1970's. However, many results have been reproved multiple times, and some early work seems to be not well well known. Also, the most comprehensive solution to the problem seems to be incomplete. In this talk, we review the history of this problem and attempt to give a complete unified treatment of the known results.