# Random linear codes over high noise binary channel

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We want to send binary messages of bit length 3 000 through a binary symmetric channel with bit error probability $p = 0.1$ such that every received vector is decoded correctly at least 4 out 5 times on average. We use nearest neighbour decoding as the decoding algorithm. We search for binary linear codes meeting the criteria above with rate as high as possible.

For such a code it is sufficient to have packet error rate PER $\leq 0.001$ in the studied range of dimensions. We estimate the PER by simulation. In particular, the codes must have an efficient decoding algorithm: we modified the standard nearest neighbour decoding algorithm with bitwise operations in order to speed up the runtime of the algorithm.

We studied random binary linear codes of dimension $k \in \{12, 13, 14, 15, 16\}$, rate $R \in \{0.25, 0.3, 0.33\}$ and density $\delta$ of the parity check matrix $\delta \in \{0.05, 0.1, \ldots, 0.4\}$. The simulations showed that codes with higher density are typically better.

In the talk some statistics of the simulations and some details on the implementation in the computer algebra system *SageMath* will be presented.

[1] W. Cary Huffman, Vera Pless, *Fundamentals of Error-Correcting Codes*, Cambridge University Press, New York, 2003.

[2] *SageMath, the Sage Mathematics Software System (Version 7.1)*, The Sage Developers, 2016, `http://www.sagemath.org`.