# Permutation codes

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The symmetric group $S_n$, consisting of permutations on $n$ elements, i.e. the set of all bijections $\{1, \ldots, n\} \to \{1, \ldots, n\}$ can be viewed as a metric space for various distance metrics. A subset $C \subseteq S_n$ is a permutation code of minimum distance $d$ for a given metric if all pairwise distances in it are at least $d$. Permutation codes have been suggested for error correction in flash memories, using an engineering paradigm called rank modulation [1] and in powerline communications [2]. They have been studied historically for the Hamming metric which counts $i$ with $\sigma(i) \neq \tau(i)$ for permutations $\sigma, \tau \in S_n$, but lately with the connection to flash memories there has been more interest in other permutation metrics.

I will investigate different permutation metrics and their properties. I shall talk more in depth about the Ulam metric, which for two permutations $\sigma, \tau \in S_n$ equals $n$ minus the length of a longest common (not necessarily consecutive) subsequence of $(\sigma(1), \ldots, \sigma(n))$ and $(\tau(1), \ldots, \tau(n))$ and mention bounds on maximum code size and ways to obtain them. Time permitting, I will talk about the connection of permutation codes, source coding, i.e. data compression, and the Bollobás-Lubell-Yamamoto-Meshalkin (LYM) and Kraft inequalities.

## References

[1] A. Jiang, R. Mateescu, M. Schwartz, and J. Bruck, "Rank modulation for flash memories," in *IEEE Trans. on Inform. Theory*, vol. 55, no. 6, pp. 2659 –2673, June 2009.

[2] D. Slepian, "Permutation modulation," *Proc. IEEE,* vol. 53, no. 3, pp. 228–236, Mar. 1965.