Sampling from the Gaussian density is a ubiquitous problem. Alongside the random samples (iid, independent identically distributed), there are deterministic samples, where sample positions are chosen as homogeneously as possible, yielding superior convergence properties. At ISAS, we developed a particularly high-quality sampling procedure based on the LCD (localized cumulative distribution).

Task 1: Sample from the standard normal distribution, taking advantage of closed form results that are possible in this case, requiring numerical optimization only.

Task 2: Sample from arbitrary, i.e., anisotropic Gaussian distributions, using numerical quadrature and optimization algorithms.

Publications and reference implementations in C++ and Julia are available.

What to do
- Understand and check mathematical derivations (supported by Mathematica, where applicable)
- Implement in Julia (and C/C++ if necessary) (ideally until publishing the repository)
- Evaluate the results

Reference: Jannik Steinbring, Nonlinear State Estimation Using Optimal Gaussian Sampling with Applications to Tracking, Chapter 2.