Quasi-random sampling with black box or acceptance-rejection inputs

Christiane Lemieux
University of Waterloo, Canada
clemieux@uwaterloo.ca

We propose randomized quasi-Monte Carlo (RQMC) methods to estimate expectations $\mu = E(g(Y, W))$ where Y is a vector of random variables independent of W and can be sampled by inversion, whereas W cannot. Various practical problems are of this form, such as estimating expected shortfall for mixture models where W is stable or generalized inverse Gaussian and Y is multivariate normal. We consider two settings: In the first, we assume that there is a non-uniform random variate generation method to sample W in the form of a non-modifiable "black-box". The methods we propose for this setting are based on approximations of the quantile function of W. In the second setting, we assume that there is an acceptance-rejection (AR) algorithm to sample from W and explore different ways to feed it with quasi-random numbers. This has been studied previously, typically by rejecting points of constant dimension from a low-discrepancy sequence and moving along the sequence. We also investigate the use of a point set of constant (target) size where the dimension of each point is increased until acceptance. In addition, we show how to combine the methods from the two settings in such a way that the non-monotonicity inherent to AR is removed.

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