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# On Confidence Intervals for Randomized Quasi-Monte Carlo Estimators

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Randomized quasi-Monte Carlo (RQMC) converges faster than standard Monte Carlo ones as the sample size increases, taking advantage of the repartition of quasi-Monte Carlo points. To get an idea of the estimation error, confidence intervals are usually built based on a central limit theorem (CLT) over independent randomizations. For a given computational budget, it means to increase the number of randomizations, limiting the size of the QMC sequence, hence its accuracy. During this talk, we will describe the challenges of building confidence intervals: we describe the existing CLTs, sufficient conditions on the relative growth rates of the number of randomizations and the quasi-Monte Carlo sequence length to ensure a central limit theorem and also an asymptotically valid confidence interval. We also compare numerically the Student t approach with two bootstrap methods for getting nonparametric confidence intervals for the mean using a modest number of replicates.

This talk is based on joint works with P. L'Ecuyer, M. Nakayama and A. Owen.

## References

- [1] M. K. Nakayama and B. Tuffin. Sufficient conditions for central limit theorems and confidence intervals for randomized quasi-Monte Carlo methods. *ACM Transactions on Modeling and Computer Simulation*, Volume 34, Issue 3, Article13, Pages 1-38, 2024.
- [2] P. L'Ecuyer, M. K Nakayama, A. B Owen, B. Tuffin. Confidence Intervals for Randomized Quasi-Monte Carlo Estimators. In the *Proceedings of the 2023 Winter Simulation Conference*, San Antonio, USA, December 2023.