



## What is Perfect Simulation, and What Can it Do Perfectly for You?

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Perfect simulation, or exact sampling, refers to a recently developed set of techniques designed to produce a sequence of independent random quantities whose distribution is guaranteed to follow a given probability law. These techniques are particularly useful in the context of Markov Chain Monte Carlo iterations, but the range of their applicability is growing rapidly. Perfect simulation algorithms provide samples with the desired exact distribution and also explicitly determine how many steps are necessary in the Markov Chain to achieve the desired outcome. These characteristics contrast sharply with the typical MCMC process used in a Bayesian inference problem. In the latter, one must estimate of the number of iterates needed in an appropriate burn-in sequence before the output of the process may be treated as a random sample from a distribution which suitably approximates the exact posterior distribution. Although it is harder to design a perfect simulation scheme than to design a Metropolis-Hastings algorithm or a Gibbs sampler in a given problem, it is clear that the output of a perfect simulation is more reliable. There are many probability calculations and inferential contexts in which an exact sample is desired. Perfect simulation is a powerful tool that a wide range of probabilists and statisticians would find useful as part of their problem-solving arsenal.

**Key words:** Coupling from the past, clan of ancestors, impatient user bias