

CHAPTER 2

RANDOM NUMBER GENERATION

The material in this chapter presumes some knowledge of integer arithmetic and elementary number theory; for background material see Appendix B.

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Discrete-event and Monte Carlo simulation cannot be done correctly without access to a good random number generator. Ideally, computer users should be able to assume the existence of a good system-supplied generator that can be used as a “black box” like other standard, reliable mathematical functions (`sqrt`, `sin`, `exp`, etc.). Unfortunately, history suggests this is frequently a false assumption. For that reason, the first two sections of this chapter provide a comprehensive discussion of an easily understood random number generation algorithm that can be used with confidence.

Section 2.1 is introductory, beginning with a conceptual model of the two-parameter algorithm as equivalent to drawing, at random, from an urn whose contents are determined by the choice of parameters. Given an appropriate choice of parameter values, Section 2.2 is primarily concerned with the important issue of correct algorithm implementation. That is, a software implementation of the random number generation algorithm is developed that is correct, efficient, and portable to essentially any contemporary computing system. This software implementation is then used in Section 2.3 as the basis for introducing Monte Carlo simulation as it relates to the estimation of probabilities.

Section 2.4 provides Monte Carlo examples that are more involved and interesting than those in the third section. Unlike the material in the first two sections, which is specific to a particular random number generation algorithm, Section 2.5 provides a more general discussion of random number generation algorithms.