Programming for Simulation and MC Methods

Random Variable Generation

Inverse Transform

The Inverse Transform

There is a simple, sometimes useful transformation, known as the *probability integral transform*, that allows us to transform any random variable into a uniform random variable and, more importantly, vice versa. For example, if X has density f and cdf F, then we have the relation

$$F(x) = \int_{-\infty}^{x} f(t)\,\mathrm{d}t,$$

and if we set $U = F(X)$, then U is a random variable distributed from a uniform $\mathcal{U}(0,1)$. This is because

$$P(U \leq u) = P[F(X) \leq F(x)] = P[F^{-1}(F(X)) \leq F^{-1}(F(x))] = P(X \leq x),$$

Accept-Reject Method

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Algorithm 1 Accept–Reject Method

1. Generate $Y \sim g$, $U \sim \mathcal{U}_{[0,1]}$;
2. Accept $X = Y$ if $U \leq f(Y)/Mg(Y)$;
3. Return to 1 otherwise.