Inverse CDF sampling is a method for obtaining samples from both discrete and continuous probability distributions that requires the CDF to be invertable. The method proposes a CDF value from a Uniform random variable on [0, 1] which is then used as input into the inverted CDF to generate a sample with the desired discrete or continuous distribution. Here examples for both cases are discussed. For the continuous case a proof is given that demonstrates the samples produced have the expected distribution.

Sampling Discrete Distributions

A discrete probability distribution consisting of a finite set of N probability values is defined by,

$$p = \{p_1, p_2, \ldots, p_N\}$$

with,

$$\sum_{i=1}^{N} p_i = 1$$

The CDF specifies the probability that $i \leq n$ and is given by,

$$P(n) = \sum_{i=1}^{n} p_i, \tag{1}$$

where $P(N) = 1$.

Consider the following disrete distribution,

$$p = \left\{ \frac{1}{12}, \frac{1}{12}, \frac{1}{6}, \frac{1}{6}, \frac{1}{12}, \frac{5}{12} \right\} \tag{2}$$