Discrete distributions

The table below gives an overview of the various discrete distributions described in ModelAssist, so that you can most easily focus on which ones might be most appropriate for your modeling needs. Follow the links for an in-depth explanation of each. We have used the most common name for each distribution.

Distributions	Example use
Bernoulli	Returns a 1 with probability p and a zero otherwise.
Binomial	Shows the number of successes from n independent trials where there is a probability p of success in each trial.
Beta-binomial	A binomial variable where p is also a Beta-distributed random variable.
Discrete	Describes a variable that can take one of several explicit discrete values with different probabilities.
Discrete uniform	Describes a variable that can take one of several explicit discrete values with equal probabilities.
Geometric	Models the total number of trials that will occur before a success, given that p is the probability of succeeding.
Hypergeometric	Models the number of items of a particular type there will be in a sample of size n where that sample is drawn from a population of size M of which D are also of that particular type.
Integer uniform	Describe a variable that can take one of several sequential discrete values.
Inverse Hypergeometric	Models the total number of trials one would have to do before achieving the s-th success in a hypergeometric sampling.
Logarithmic	A one parameter, positive distribution sometimes used to model frequency of insurance claims. Also used for insect species abundance
Multinomial	An extension of the Binomial distribution where more than two different states of a trial exist.
Multivariate Hypergeometric	An extension of the Hypergeometric distribution where more than two sub-populations of interest exist.
Negative Binomial	Models the total number of trials there will be before s successes are achieved where there is a probability p of success with each trial. Also models a Poisson random variable whose mean is a (Gamma) random variable.
Poisson	Models the number of occurrences of an event in a time t when the time between successive events follows a Poisson process

A discrete distribution may take one of a set of identifiable values, each of which has a calculable probability of occurrence. Discrete distributions are used to model parameters like the number of bridges a roading scheme may need, the number of key personnel to be employed or the number of customers that will arrive at a service station in an hour. Clearly, variables such as these can only take specific values: one cannot build half a bridge, employ 2.7 people or serve 13.6 customers.

The vertical scale of a relative frequency plot of a discrete distribution is the actual probability of occurrence, sometimes called the *probability mass*. These probabilities must sum to one.

The most common examples of discrete distributions are: Binomial, Geometric, Hypergeometric, Negative Binomial, Poisson and, of course, the generalized Discrete distribution. The links below discuss different ways of categorizing distributions that may help in your selection of the most appropriate distribution to use:

Bounded and unbounded distributions

Parametric and non-parametric distributions