# RandGen Add-In

The purpose of this add-in is to provide a collection of Excel functions for generating random numbers from various well-known probability distributions. The functions in this add-in are intended to be used with the author’s simulation program, to be packaged with his Data Analysis for Decision Making 7e book, but they can be used for generating random numbers for any purpose.

The add-in is written as an XLL, a special type of DLL (dynamic-link library) that Excel understands. Its code references several Excel functions, such as BINOM\_INV, that were introduced in Excel 2010, so the add-in shouldn’t be used for pre-2010 versions of Excel. Also, the add-in works only with Excel for Windows; it does *not* work with Excel for the Mac.

## Installation

To install the add-in, double-click the Setup.exe file inside the RandGenSetup.zip file and follow instructions. Once it has been installed and you open the Excel Add-Ins list, you will see a RandGen item that you can check or uncheck. (To see the Excel Add-Ins list, click Options from the File menu, then Add-Ins, then the Go button at the bottom.)

The resulting random functions act just like built-in Excel functions. For example, you could enter the formula **=Normal\_(100,10)** in any cell to generate a normally distributed random number, or you could then copy this formula to other cells to get several (independent) normally distributed random numbers.

There is no Help file associated with these functions, except what you’re reading now.

## List of Random Functions

There are 14 random functions available, each for generating a random number from the corresponding distribution. The first four are discrete distributions; the last 10 are continuous distributions. (There is also a 15th function, Corr\_, discussed below.)

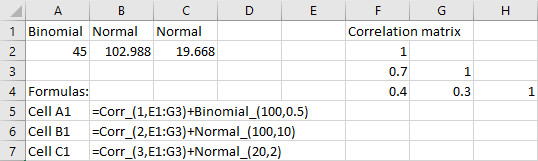
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| --- | --- | --- | --- |
| Distribution | Function and arguments | Restrictions on arguments | Comments |
| Bernoulli | Bernoulli\_(p) | 0<=p<=1 | 1 if a success, 0 otherwise, where success has probability p |
| Binomial | Binomial\_(n,p) | n>=0, 0<=p<=1 | Number of successes in n independent trials, where p is the probability of success on each trial |
| Poisson | Poisson\_(mean) | mean>0 | Nonnegative integer-valued, often used for the number of events in some amount of time or place |
| Discrete | Discrete\_(values,probs) | # of values must match # of probs, and probs must sum to 1 | General discrete distribution where values is any list of possible values and probs is the corresponding list of probabilities |
| Uniform | Uniform\_(min,max) | min<=max | Flat distribution, where any value between min and max is equally likely |
| Normal | Normal\_(mean,stdev) | stdev>0 | Famous symmetric bell-shaped distribution with given mean and standard deviation |
| Triangular | Triangular\_(min,mostlikely,max) | min<=mostlikely<=max | Distribution bounded by min and max, with peak at mostlikely value |
| Pert | Pert\_(min,mostlikely,max) | min<=mostlikely<=max | A “rounded” version of the triangular distribution |
| Beta | Beta\_(alpha1,alpha2,min,max) | alpha1>0, alpha2>0, min<=max | Bounded by min and max, shape determined by alpha1 and alpha2 |
| Exponential | Exponential\_(mean) | mean>0 | Nonnegative “memoryless” distribution with given mean and mode at 0 |
| Erlang | Erlang\_(n,beta) | n>0, n integer, beta>0 | Right-skewed nonnegative distribution with integer shape parameter n and mean equal to n\*beta |
| Gamma | Gamma\_(alpha,beta) | alpha>0, beta>0 | Generalization of Erlang distribution where the shape parameter alpha can be any nonnegative value. Mean is alpha\*beta. |
| Lognormal | Lognormal\_(mean,stdev) | mean>0, stdev>0 | Right-skewed nonnegative distribution with given mean and standard deviation |
| Weibull | Weibull\_(alpha,beta) | alpha>0, beta>0 | Right-skewed nonnegative distribution with shape parameter alpha and scale parameter beta. Mean is a complex function of alpha and beta. |

**Notes:**

1. Don’t forget that each of these functions has an underscore (\_) at the end of its name.
2. Like built-in Excel functions, each argument of these random functions can be a cell reference. In particular, the arguments of the Discrete\_ function can be references to ranges of values and probabilities.
3. If you supply an “illegal” argument to any of these functions, you will get a #NUM! error. For example, =Normal\_(10,-2) will produce this error.

## Correlating Random Numbers

The Corr\_ function, in conjunction with the author’s simulation program, lets you correlate random numbers. It has two arguments: an index of the variable being correlated and a reference to a correlation matrix. The following example illustrates its use:



**Notes:**

1. In this example, the indexes are 1, 2, and 3, corresponding to the rows (or columns) of the correlation matrix. For example, the random numbers in cells A1 and C1, with indexes 1 and 3, have correlation 0.4.
2. Unless the first argument is not an integer, the Corr\_ function returns the value 0, so adding it to a function like Normal\_ doesn’t change the latter function’s value. If the first argument is not an integer, the Corr\_ function returns a #NUM! error.
3. As this example illustrates, you can correlate random values from the same distribution or from different distributions.
4. Without the author’s simulation program, the Corr\_ function has no effect. This simulation program checks that (1) the correlation matrix is square (# of rows equals # of columns), (2) the indexes of the variables go from 1 to then size of the correlation matrix, and (3) the correlation matrix has “valid” correlations (meaning that there exists a data set that could produce this correlation matrix, or, more technically, the matrix is positive semidefinite). If these conditions hold, the simulated values of the variables are then correlated according to the correlations in the correlation matrix.