1 Short Help on random and randn

You can use the `random` command to generate random vectors and matrices. The following illustrates the syntax of the `random` command.

\[
R = \text{random('ProbabilityDistribution',Parameter1,...,ParameterN,#rows,#cols);}
\]

For Gaussian or Normal, the distribution is of type `norm`, `Parameter1` is the mean, and `Parameter2` is the standard deviation. For this type of distribution, only these parameters are required. Remember that the standard deviation is the square root of the variance. A listing of the supported distributions for `random` is contained in Matlab’s help file, also included in the section below.

**Example:** Suppose you want to generate a signal vector of Gaussian noise. To generate a row vector of length 10, containing Gaussian distributed numbers with mean 5 and variance 2, you would type

\[
R = \text{random('norm',5,sqrt(2),1,10);}
\]

The Matlab command `randn` generates samples of a Gaussian distributed random variable with mean 0 and variance 1. To obtain a mean other than zero, just add or subtract a constant from the generated vector. To obtain a variance other than one, multiply the generated vector by the standard deviation (square root of the variance).

**Example:** To generate a length 10 row vector of Gaussian distributed numbers with mean 5 and variance 2, you would type

\[
R = \text{sqrt(2).*randn(1,10) + 5;}
\]

Note that `randn` executes significantly faster than `random`, so this would be the preferred function in longer simulations.

2 Matlab Help on random

**RANDOM** Generate random arrays from a specified distribution.

\[
R = \text{RANDOM(NAME,A)} \quad \text{returns an array of random numbers chosen from the one-parameter probability distribution specified by NAME with parameter values A.}
\]

\[
R = \text{RANDOM(NAME,A,B)} \quad \text{or} \quad R = \text{RANDOM(NAME,A,B,C)} \quad \text{returns an array of random numbers chosen from a two- or three-parameter probability distribution with parameter values A, B (and C).}
\]

The size of R is the common size of the input arguments. A scalar input
functions as a constant matrix of the same size as the other inputs.

\[ R = \text{RANDOM}(\text{NAME}, A, [M,N,...]) \] or \[ R = \text{RANDOM}(\text{NAME}, A, [M,N,...]) \] returns an M-by-N-by-... array of random numbers for a one-parameter distribution. Similarly, \[ R = \text{RANDOM}(\text{NAME}, A, B, [M,N,...]) \] or \[ R = \text{RANDOM}(\text{NAME}, A, B, [M,N,...]) \], and \[ R = \text{RANDOM}(\text{NAME}, A, B, C, [M,N,...]) \] or \[ R = \text{RANDOM}(\text{NAME}, A, B, C, [M,N,...]) \], return an M-by-N-by-... array of random numbers for a two- or three-parameter distribution.

\text{NAME} can be:

- 'beta' or 'Beta',
- 'bino' or 'Binomial',
- 'chi2' or 'Chisquare',
- 'exp' or 'Exponential',
- 'ev' or 'Extreme Value',
- 'f' or 'F',
- 'gam' or 'Gamma',
- 'gev' or 'Generalized Extreme Value',
- 'gp' or 'Generalized Pareto',
- 'geo' or 'Geometric',
- 'hyge' or 'Hypergeometric',
- 'logn' or 'Lognormal',
- 'nbin' or 'Negative Binomial',
- 'ncf' or 'Noncentral F',
- 'nct' or 'Noncentral t',
- 'ncx2' or 'Noncentral Chi-square',
- 'norm' or 'Normal',
- 'poiss' or 'Poisson',
- 'rayl' or 'Rayleigh',
- 't' or 'T',
- 'unif' or 'Uniform',
- 'unid' or 'Discrete Uniform',
- 'wbl' or 'Weibull'.

Partial matches are allowed and case is ignored.

\text{RANDOM} calls many specialized routines that do the calculations.

See also \text{cdf}, \text{icdf}, \text{mle}, \text{pdf}.
3 Matlab Help on randn

RANDN  Normally distributed random numbers.
R = RANDN(N) returns an N-by-N matrix containing pseudo-random values
drawn from a normal distribution with mean zero and standard deviation
one. RANDN(M,N) or RANDN([M,N]) returns an M-by-N matrix. RANDN(M,N,P,...)
or RANDN([M,N,P,...]) returns an M-by-N-by-P-by-... array. RANDN with
no arguments returns a scalar. RANDN(SIZE(A)) returns an array the
same size as A.

You can use one of two generator algorithms, as follows:

RANDN(METHOD,S) causes RANDN to use the generator determined by METHOD, and
initializes the state of that generator. S is a scalar integer value from
0 to 2^32-1, or the output of RANDN(METHOD). METHOD is one of the
following strings:

'state' - Use Marsaglia’s Ziggurat algorithm, the default in MATLAB
         Versions 5 and later. The period is approximately 2^64.

'seed' - Use the polar algorithm, the default in MATLAB Version 4.
         The period is approximately (2^31-1)*(pi/8).

RANDN(METHOD) returns the current internal state of the generator
determined by METHOD. However, it does not switch generators.

The sequence of numbers produced by RANDN is determined by the internal
state of the generator. Setting the generator to the same fixed state
allows computations to be repeated. Setting the generator to different
states leads to unique computations, however, it does not improve any
statistical properties. Since MATLAB resets the state at start-up, RANDN
will generate the same sequence of numbers in each session unless the
state is changed.

Note: The size inputs M, N, and P... should be nonnegative integers.
Negative integers are treated as 0.

Examples:

Return RANDN to its default initial state.
randn('state',0)

Initialize RANDN to a different state each time.
randn('state',sum(100*clock))
Save the current state, generate 100 values, reset the state, and repeat the sequence.

```matlab
s = randn('state');
r1 = randn(100);
rndn('state',s);
r2 = randn(100); % contains exactly the same values as r1
```

Generate normal values with mean 1 and standard deviation 2.

```matlab
r = 1 + 2.*randn(100,1);
```

See also `rand`, `sprand`, `sprandn`, `randperm`.