

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=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=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=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 = RANDOM(NAME,A) returns an array of random numbers chosen from the one-parameter probability distribution specified by NAME with parameter values A.

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

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.

RANDOM calls many specialized routines that do the calculations.

See also `cdf`, `icdf`, `mle`, `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.

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

Generate normal values with mean 1 and standard deviation 2.

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

See also rand, sprand, sprandn, randperm.