

NAG Toolbox

nag_rand_dist_chisq (g05sd)

1 Purpose

nag_rand_dist_chisq (g05sd) generates a vector of pseudorandom numbers taken from a χ^2 -distribution with ν degrees of freedom.

2 Syntax

```
[state, x, ifail] = nag_rand_dist_chisq(n, df, state)
[state, x, ifail] = g05sd(n, df, state)
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{x^{\nu/2-1} \times e^{-x/2}}{2^{\nu/2} \times (\nu/2 - 1)!} \quad \text{if } x > 0;$$

$$f(x) = 0 \quad \text{otherwise.}$$

This is the same as a gamma distribution with parameters $\nu/2$ and 2.

One of the initialization functions nag_rand_init_repeat (g05kf) (for a repeatable sequence if computed sequentially) or nag_rand_init_nonrepeat (g05kg) (for a non-repeatable sequence) must be called prior to the first call to nag_rand_dist_chisq (g05sd).

4 References

Kendall M G and Stuart A (1969) *The Advanced Theory of Statistics (Volume 1)* (3rd Edition) Griffin
 Knuth D E (1981) *The Art of Computer Programming (Volume 2)* (2nd Edition) Addison–Wesley

5 Parameters

5.1 Compulsory Input Parameters

1: **n** – INTEGER

n , the number of pseudorandom numbers to be generated.

Constraint: $n \geq 0$.

2: **df** – INTEGER

ν , the number of degrees of freedom of the distribution.

Constraint: $df \geq 1$.

3: **state**(:) – INTEGER array

Note: the actual argument supplied **must** be the array **state** supplied to the initialization routines nag_rand_init_repeat (g05kf) or nag_rand_init_nonrepeat (g05kg).

Contains information on the selected base generator and its current state.

5.2 Optional Input Parameters

None.

5.3 Output Parameters

- 1: **state**(:) – INTEGER array
Contains updated information on the state of the generator.
- 2: **x**(**n**) – REAL (KIND=nag_wp) array
The n pseudorandom numbers from the specified χ^2 -distribution.
- 3: **ifail** – INTEGER
ifail = 0 unless the function detects an error (see Section 5).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

Constraint: **n** \geq 0.

ifail = 2

Constraint: **df** \geq 1.

ifail = 3

On entry, **state** vector has been corrupted or not initialized.

ifail = -99

An unexpected error has been triggered by this routine. Please contact NAG.

ifail = -399

Your licence key may have expired or may not have been installed correctly.

ifail = -999

Dynamic memory allocation failed.

7 Accuracy

Not applicable.

8 Further Comments

The time taken by nag_rand_dist_chisq (g05sd) increases with ν .

9 Example

This example prints five pseudorandom numbers from a χ^2 -distribution with five degrees of freedom, generated by a single call to nag_rand_dist_chisq (g05sd), after initialization by nag_rand_init_repeat (g05kf).

9.1 Program Text

```
function g05sd_example
fprintf('g05sd example results\n\n');

% Initialize the base generator to a repeatable sequence
seed = [nag_int(1762543)];
genid = nag_int(1);
subid = nag_int(1);
[state, ifail] = g05kf( ...
                    genid, subid, seed);

% Number of variates
n = nag_int(5);

% Parameters
df = nag_int(5);

% Generate variates from Chi^2 distribution
[state, x, ifail] = g05sd( ...
                      n, df, state);

disp('Variates');
disp(x);
```

9.2 Program Results

```
g05sd example results

Variates
  4.4731
  5.9371
  1.7636
  2.9812
  4.3280
```
