nag_return_multi_normal (g05ezc)

1. Purpose

nag_return_multi_normal (g05ezc) generates a pseudo-random multivariate Normal vector taken from a distribution described by a reference vector set up by nag_ref_vec_multi_normal (g05eac).

2. Specification

```
#include <nag.h>
#include <nagg05.h>

void nag_return_multi_normal(double z[], double *r)
```

3. Description

This routine is designed for use in conjunction with nag_ref_vec_multi_normal (g05eac). The description of nag_ref_vec_multi_normal (g05eac) should be referred to for a specification of the operation of these two routines.

4. Parameters

z[n]
where n is the number of dimensions of the distribution as supplied to nag_ref_vec_multi_normal (g05eac).
Output: the pseudo-random multivariate Normal vector.

r
Input: the reference vector to which memory has been allocated as set up by nag_ref_vec_multi_normal (g05eac). To free this memory the macro NAG_FREE should be added in the users' program after the final call to nag_return_multi_normal.

5. Error Indications and Warnings

None.

6. Further Comments

The time taken by the routine is of the order

$$a + b \times n + c \times n^2$$

where a and b are appreciably (say 10-20 times) larger than c.

6.1. Accuracy

The accuracy is discussed in the routine document for nag_ref_vec_multi_normal (g05eac).

6.2. References

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

7. See Also

nag_random_init_repeatable (g05cbc)
nag_random_init_nonrepeatable (g05ccc)
nag_random_normal (g05ddc)
nag_ref_vec_multi_normal (g05eac)

8. Example

The example program prints five pseudo-random observations from a bivariate Normal distribution with means vector

$$\begin{bmatrix} 1.0 \\ 2.0 \end{bmatrix}$$

and covariance matrix

$$\begin{bmatrix} 2.0 & 1.0 \\ 1.0 & 3.0 \end{bmatrix},$$

generated by nag_ref_vec_multi_normal (g05eac) and nag_return_multi_normal after initialisation by nag_random_init_repeatable (g05cbc).

8.1. Program Text

```
/* nag_return_multi_normal(g05ezc) Example Program
 *
 * Copyright 1991 Numerical Algorithms Group.
 *
 * Mark 2, 1991.
 *
 * Mark 3 revised, 1994.
 */

#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <nagg05.h>


#define N 2
#define TDC N

main()
{
  Integer i, j;
  double a[N], c[N][TDC], z[N];
  double *r;
  double eps = 0.01;

  Vprintf("g05ezc Example Program Results\n");
  a[0] = 1.0;
  a[1] = 2.0;
  c[0][0] = 2.0;
  c[1][1] = 3.0;
  c[0][1] = 1.0;
  c[1][0] = 1.0;
  g05cbc((Integer)0);
  g05eac(a, (Integer)N, (double *)c, (Integer)TDC,
         eps, &r, NAGERR_DEFAULT);
  for (i=1; i<=5; i++)
    {
      g05ezc(z, r);
      for (j=0; j<(Integer)N; j++)
        Vprintf("%10.4f", z[j]);
      Vprintf("\n");
    }
  NAG_FREE(r);
  exit(EXIT_SUCCESS);
}
```

8.2. Program Data

None.

8.3. Program Results

```
g05ezc Example Program Results
    1.7697    4.4481
    3.2678    3.0583
    3.1769    2.3651
   -0.1055    1.8395
    1.2933   -0.1850
```