NAG C Library Function Document

nag_ref_vec_poisson (g05ecc)

1 Purpose

nag_ref_vec_poisson (g05ecc) sets up the reference vector **r** for a Poisson distribution with mean t.

2 Specification

```
#include <nag.h>
#include <nagg05.h>
void nag_ref_vec_poisson(double t, double **r, NagError *fail)
```

3 Description

This sets up a reference vector for use in nag_return_discrete (g05eyc). Together these routines produce random numbers from the Poisson distribution defined by:

$$\begin{aligned} P(I=i) &= \frac{t^i e^{-t}}{i!} && \text{if } i = 0, 1, \ldots \\ P(I=i) &= 0 && \text{otherwise.} \end{aligned}$$

The reference array is found using a recurrence relation if t is less than 50 and by Stirling's formula otherwise.

4 Parameters

1: **t** – double *Input*

On entry: the mean, t, of the distribution.

Constraint: **t** ≥ 0.

2: **r** – double ** *Output*

On exit: reference vector for which memory will be allocated internally. If no memory is allocated to **r** (e.g., when an input error is detected) then **r** will be NULL on return, otherwise the user should use the NAG macro NAG_FREE to free the storage allocated by **r** when it is no longer of use.

3: **fail** – NagError * *Input/Output*

The NAG error parameter (see the Essential Introduction).

5 Error Indicators and Warnings

NE_REAL_ARG_LT

On entry, **t** must not be less than 0.0: **t** = <*value*>.

NE_ALLOC_FAIL

Memory allocation failed.

6 Further Comments

6.1 Accuracy

Not applicable.

6.2 References

Kendall M G and Stuart A (1969) *The Advanced Theory of Statistics (Volume 1)* Griffin (3rd Edition)

Knuth D E (1981) *The Art of Computer Programming (Volume 2)* Addison-Wesley (2nd Edition)

7 See Also

nag_random_init_repeatable (g05cbc)
nag_random_init_nonrepeatable (g05ccc)
nag_random_exp (g05dbc)
nag_random_normal (g05ddc)
nag_ref_vec_binomial (g05edc)
nag_return_discrete (g05eyc)

8 Example

The example program sets up a reference for a Poisson distribution with mean 2.7 and then prints the first five pseudo-random numbers generated by nag_return_discrete (g05eyc), after initialisation by nag_random_init_repeatable (g05cbc).

8.1 Program Text

```
/* nag_ref_vec_poisson(g05ecc) 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>

main()
{
  Integer i, x;
  double *r;
  double t = 2.7;

  Vprintf("g05ecc Example Program Results\n");
  g05cbc((Integer)0);
  g05ecc(t, &r, NAGERR_DEFAULT);
  for (i=1; i<=5; i++)
    {
      x = g05eyc(r);
      Vprintf("%5ld\n",x);
    }
  NAG_FREE(r);
  exit(EXIT_SUCCESS);
}
```

8.2 Program Data

None.

8.3 Program Results

```
g05ecc Example Program Results
    4
    1
    2
    1
    5
```