nag_ref_vec_binomial (g05edc)

1. Purpose

`nag_ref_vec_binomial (g05edc)` sets up the reference vector `r` for a binomial distribution of the number of successes in `n` trials, each with probability of success `p`.

2. Specification

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

void nag_ref_vec_binomial(Integer n, double p, double **r, NagError *fail)
```

3. Description

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

\[
P(I = i) = \frac{n!}{i!(n - i)!}p^i(1 - p)^{n - i} \quad \text{if } i = 0, \ldots, n,
\]

\[
P(I = i) = 0 \quad \text{otherwise}
\]

The reference array is found by a recurrence relation if \(np(1 - p) < 50\); otherwise Stirling’s approximation is used.

4. Parameters

- `n`
  - Input: the number of trials, `n`, of the distribution.
  - Constraint: \(n \geq 0\).

- `p`
  - Input: the probability of success, `p`, of the distribution.
  - Constraint: \(0.0 \leq p \leq 1.0\).

- `r`
  - Output: 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.

- `fail`
  - The NAG error parameter, see the Essential Introduction to the NAG C Library.

5. Error Indications and Warnings

- **NE_INT_ARG_LT**
  - On entry, `n` must not be less than 0: `n = ⟨value⟩`.

- **NE_REAL_ARG_LT**
  - On entry, `p` must not be less than 0.0: `p = ⟨value⟩`.

- **NE_REAL_ARG_GT**
  - On entry, `p` must not be greater than 1.0: `p = ⟨value⟩`.

- **NE_ALLOC_FAIL**
  - Memory allocation failed.

6. Further Comments

6.1. Accuracy

Not applicable.
6.2. References


7. See Also

nag_random_init_repeatable (g05cbc)
nag_random_init_nonrepeatable (g05ccc)
nag_random_normal (g05ddc)
nag_ref_vec_poisson (g05ecc)
nag_return_discrete (g05eyc)

8. Example

The example program sets up a reference vector for a binomial distribution with \( n = 100 \) and \( p = 0.5 \); it 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

```c
#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <nagg05.h>
#define N 100
#define P 0.5

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

    Vprintf("g05edc Example Program Results\n");
    g05cbc((Integer)0);
    g05edc((Integer)N, (double)P, &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

```
g05edc Example Program Results
54
46
48
46
56
```

---

nag_ref_vec_binomial

NAG C Library Manual