

NAG C Library Function Document

nag_deviates_landau (g01ftc)

1 Purpose

nag_deviates_landau (g01ftc) returns the value of the inverse $\Phi^{-1}(x)$ of the Landau distribution function.

2 Specification

```
double nag_deviates_landau (double x, NagError *fail)
```

3 Description

nag_deviates_landau (g01ftc) evaluates an approximation to the inverse $\Phi^{-1}(x)$ of the Landau distribution function given by

$$\Psi(x) = \Phi^{-1}(x)$$

(where $\Phi(\lambda)$ is described in nag_prob_landau (g01etc) and nag_prob_density_landau (g01mtc)), using either linear or quadratic interpolation or rational approximations which mimic the asymptotic behaviour. Further details can be found in Kölbig and Schorr (1984).

It can also be used to generate Landau distributed random numbers in the range $0 < x < 1$.

4 References

Kölbig K S and Schorr B (1984) A program package for the Landau distribution *Comp. Phys. Comm.* **31** 97–111

5 Parameters

- 1: **x** – double *Input*
On entry: the argument x of the function.
Constraint: $0.0 < \mathbf{x} < 1.0$.
- 2: **fail** – NagError * *Input/Output*
 The NAG error parameter (see the Essential Introduction).

6 Error Indicators and Warnings

NE_REAL

On entry, **x** = $\langle value \rangle$.
 Constraint: $\mathbf{x} < 1.0$.

On entry, **x** = $\langle value \rangle$.
 Constraint: $\mathbf{x} > 0.0$.

NE_BAD_PARAM

On entry, parameter $\langle value \rangle$ had an illegal value.

NE_INTERNAL_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please consult NAG for assistance.

7 Accuracy

At least 5 – 6 significant digits are correct. Such accuracy is normally considered to be adequate for applications in large scale Monte Carlo simulations.

8 Further Comments

None.

9 Example

The example program evaluates $\Phi^{-1}(x)$ at $x = 0.5$, and prints the results.

9.1 Program Text

```

/* nag_deviates_landau (g01ftc) Example Program.
 *
 * Copyright 2002 Numerical Algorithms Group.
 *
 * Mark 7, 2002.
 */

#include <stdio.h>
#include <nag.h>
#include <nag_stdlib.h>
#include <nagg01.h>

int main(void)
{
    /* Scalars */
    double x, y;
    Integer exit_status;
    NagError fail;

    INIT_FAIL(fail);
    exit_status = 0;

    Vprintf(" g01ftc Example Program Results\n");

    /* Skip heading in data file */
    Vscanf("%*[\n] ");

    Vscanf("%lf%*[\n] ", &x);

    y = g01ftc(x, &fail);

    if (fail.code == NE_NOERROR)
    {
        Vprintf("\n  X          Y\n\n");
        Vprintf("  %3.1f   %12.4e\n", x, y);
    }
    else
    {
        Vprintf("Error from g01ftc.\n%s\n", fail.message);
        exit_status = 1;
        goto END;
    }
END:
    return exit_status;
}

```

9.2 Program Data

```

g01ftc Example Program Data
0.5 : Value of X

```

9.3 Program Results

g01ftc Example Program Results

X	Y
0.5	1.3558e+00
