

# NAG Library Function Document

## nag\_prob\_landau (g01etc)

### 1 Purpose

nag\_prob\_landau (g01etc) returns the value of the Landau distribution function  $\Phi(\lambda)$ .

### 2 Specification

```
#include <nag.h>
#include <nagg01.h>
double nag_prob_landau (double x)
```

### 3 Description

nag\_prob\_landau (g01etc) evaluates an approximation to the Landau distribution function  $\Phi(\lambda)$  given by

$$\Phi(\lambda) = \int_{-\infty}^{\lambda} \phi(\lambda) d\lambda,$$

where  $\phi(\lambda)$  is described in nag\_prob\_density\_landau (g01mtc), using piecewise approximation by rational functions. Further details can be found in K lbig and Schorr (1984).

### 4 References

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

### 5 Arguments

1: **x** – double *Input*  
*On entry:* the argument  $\lambda$  of the function.

### 6 Error Indicators and Warnings

### 7 Accuracy

At least 7 significant digits are usually correct, but occasionally only 6. Such accuracy is normally considered to be adequate for applications in experimental physics.

Because of the asymptotic behaviour of  $\Phi(\lambda)$ , which is of the order of  $\exp[-\exp(-\lambda)]$ , underflow may occur on some machines when  $\lambda$  is moderately large and negative.

### 8 Parallelism and Performance

nag\_prob\_landau (g01etc) is not threaded in any implementation.

### 9 Further Comments

None.

## 10 Example

This example evaluates  $\Phi(\lambda)$  at  $\lambda = 0.5$ , and prints the results.

### 10.1 Program Text

```

/* nag_prob_landau (g01etc) Example Program.
 *
 * NAGPRODCODE Version.
 *
 * Copyright 2016 Numerical Algorithms Group.
 *
 * Mark 26, 2016.
 */

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

int main(void)
{
    /* Scalars */
    double x, y;
    Integer exit_status = 0;

    printf(" nag_prob_landau (g01etc) Example Program Results\n");

    /* Skip heading in data file */
#ifdef _WIN32
    scanf_s("%*[\n] ");
#else
    scanf("%*[\n] ");
#endif

#ifdef _WIN32
    scanf_s("%lf%*[\n] ", &x);
#else
    scanf("%lf%*[\n] ", &x);
#endif

    /* nag_prob_landau (g01etc).
     * Landau distribution function Phi(lambda )
     */
    y = nag_prob_landau(x);

    printf("\n  X          Y\n\n");
    printf("   %3.1f    %13.4e\n", x, y);

    return exit_status;
}

```

### 10.2 Program Data

```

nag_prob_landau (g01etc) Example Program Data
0.5 : Value of X

```

### 10.3 Program Results

```

nag_prob_landau (g01etc) Example Program Results

  X          Y
0.5        3.7328e-01

```

---