

NAG Library Function Document

nag_prob_density_landau (g01mtc)

1 Purpose

nag_prob_density_landau (g01mtc) returns the value of the Landau density function $\phi(\lambda)$.

2 Specification

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

3 Description

nag_prob_density_landau (g01mtc) evaluates an approximation to the Landau density function $\phi(\lambda)$ given by

$$\phi(\lambda) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \exp(\lambda s + s \ln s) ds,$$

where c is an arbitrary real constant, using piecewise approximation by rational functions. Further details can be found in Kölbig and Schorr (1984).

To obtain the value of $\phi'(\lambda)$, nag_prob_der_landau (g01rtc) can be used.

4 References

Kölbig 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 λ 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 λ is moderately large and negative.

8 Parallelism and Performance

Not applicable.

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_density_landau (g01mtc) Example Program.
 *
 * Copyright 2014 Numerical Algorithms Group.
 *
 * Mark 7, 2002.
 */

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

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

    printf(" nag_prob_density_landau (g01mtc) 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_density_landau (g01mtc).
     * Landau density function phi(lambda)
     */
    y = nag_prob_density_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_density_landau (g01mtc) Example Program Data
0.5 : Value of X

```

10.3 Program Results

```

nag_prob_density_landau (g01mtc) Example Program Results

 X          Y
0.5      1.6523e-01

```
