NAG Toolbox for MATLAB

g01mb

1 Purpose

g01mb returns the reciprocal of Mills' Ratio, via the function name.

2 Syntax

```
[result] = g01mb(x)
```

3 Description

g01mb calculates the reciprocal of Mills' Ratio, the hazard rate, $\lambda(x)$, for the standard Normal distribution. It is defined as the ratio of the ordinate to the upper tail area of the standard Normal distribution, that is,

$$\lambda(x) = \frac{Z(x)}{Q(x)} = \frac{\frac{1}{\sqrt{2\pi}}e^{-\left(x^2/2\right)}}{\frac{1}{\sqrt{2\pi}}\int_x^\infty e^{-(t^2/2)}\,dt}.$$

If $x \leq 9.0$, then the calculation is based on a Chebyshev expansion as described in s15ad; otherwise, the method due to Swan 1969 is used.

4 References

Gross A J and Clark V A 1975 *Survival Distributions: Reliability Applications in the Biomedical Sciences* Wiley

Swan A V 1969 Algorithm AS17. The reciprocal of Mills's ratio *Appl. Statist.* **18** 115

5 Parameters

5.1 Compulsory Input Parameters

1: **x – double scalar**

x, the argument of the reciprocal of Mills' Ratio.

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **result – double scalar**

The result of the function.

6 Error Indicators and Warnings

None.

7 Accuracy

In the left-hand tail, $x < 0.0$, if $\frac{1}{2}e^{-(1/2)x^2} \leq$ the safe range parameter (x02am), then 0.0 is returned, which is close to the true value.

The relative accuracy is bounded by the effective ***machine precision***. See s15ad for further discussion for the case $x \leq 9.0$.

8 Further Comments

If, before entry, x is not a standard Normal variable, it has to be standardized, and on exit, g01mb has to be divided by the standard deviation. That is, if the Normal distribution has mean μ and variance σ^2, then its hazard rate, $\lambda\left(x;\mu,\sigma^2\right)$, is given by

$$\lambda\left(x;\mu,\sigma^2\right) = \lambda((x-\mu)/\sigma)/\sigma.$$

9 Example

```
x = 0;
[result] = g01mb(x)
```

```
result =
    0.7979
```