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Landau Distribution

The LANDAU function subprogram package contains six independent subprograms for the calculation of the following functions related to the Landau distribution:

$$\begin{aligned}
 \text{The density} \quad \phi(\lambda) &= \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \exp(\lambda s + s \ln s) ds, \\
 \text{the distribution} \quad \Phi(\lambda) &= \int_{-\infty}^{\lambda} \phi(\lambda) d\lambda, \\
 \text{the derivative} \quad \phi'(\lambda) &= \frac{d\phi(\lambda)}{d\lambda}, \\
 \text{the first moment} \quad \Phi_1(x) &= \frac{1}{\Phi(x)} \int_{-\infty}^x \lambda \phi(\lambda) d\lambda, \\
 \text{the second moment} \quad \Phi_2(x) &= \frac{1}{\Phi(x)} \int_{-\infty}^x \lambda^2 \phi(\lambda) d\lambda, \\
 \text{the inverse of } \Phi(x) \quad \Psi(x) &= \Phi^{-1}(x).
 \end{aligned}$$

The function $\Psi(x)$ can be used to generate Landau random numbers (see **Usage**).

Structure:

FUNCTION subprograms

User Entry Names: DENLAN, DISLAN, DIFLAN, XM1LAN, XM2LAN, RANLAN

Obsolete User Entry Names: DSTLAN \equiv DISLAN

Usage:

In any arithmetic expression,

DENLAN(X)	has the value	$\phi(X)$,
DISLAN(X)	has the value	$\Phi(X)$,
DIFLAN(X)	has the value	$\phi'(X)$,
XM1LAN(X)	has the value	$\Phi_1(X)$,
XM2LAN(X)	has the value	$\Phi_2(X)$,
RANLAN(X)	has the value	$\Psi(X)$,

where DENLAN, DISLAN, DIFLAN, XM1LAN, XM2LAN, RANLAN and X are of type REAL.

To generate a set of Landau random numbers, RANLAN should be referenced repeatedly, using as argument a random number from a uniform distribution over the interval (0,1).

Method:

Approximation by rational functions. For reason of speed, RANLAN proceeds mainly by table look-up and quadratic interpolation.

Accuracy:

At least six significant digits (five for RANLAN) are correct.

Restrictions:

1. Underflow may occur for DENLAN, DISLAN and DIFLAN if X is negative and (moderately) large.
2. No test is made whether X for RANLAN lies outside the interval (0,1), and hence no error message is printed.

Notes:

This program package is a version of the *CPC Program Library* package LANDAU (Ref. 1).

References:

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

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