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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:

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

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

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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