

# Package ‘NtLKwIEx’

January 20, 2025

**Type** Package

**Title** Computation of NtLKwIEx Distribution Properties

**Version** 0.1.0

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**Description** Implements statistical tools for analyzing, simulating, and computing properties of the New Topp-Leone Kumaraswamy Inverse Exponential (NtLKwIEx) distribution. See Atchadé M, Otodji T, and Djibiril A (2024) <[doi:10.1063/5.0179458](https://doi.org/10.1063/5.0179458)> and Atchadé M, Otodji T, Djibiril A, and N'bouké M (2023) <[doi:10.1515/phys-2023-0151](https://doi.org/10.1515/phys-2023-0151)> for details.

**Depends** R (>= 3.6.0), stats, dplyr, ggplot2

**License** GPL-2

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.2.3

**VignetteBuilder** knitr

**Suggests** knitr, rmarkdown, testthat (>= 3.0.0)

**Language** fr

**Config/testthat/edition** 3

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2024-02-05 19:30:07 UTC

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ConductorFailureTimes *Dataset: ConductorFailureTimes*

### Description

This dataset contains failure times measured in hours from an accelerated life test with 59 conductors.

### Usage

```
data(ConductorFailureTimes)
```

### Format

A numeric vector of failure times.

### Details

This dataset contains failure times (measured in hours) obtained from an accelerated life test involving 59 conductors. The data are presented as a numeric vector.

### References

- Nasiri, B., et al. (2010). "Bayesian analysis of the accelerated life model with Type-II censoring." *Journal of Statistical Planning and Inference*, 140(6), 1565-1572.
- Schafft, H. A., et al. (1987). "Reproducibility of the accelerated test for electric cable insulation." *IEEE Transactions on Electrical Insulation*, 22(5), 739-746.

C\_NTLKwIEx *Cumulative Distribution Function (CDF) of the NTLKwIEx distribution*

### Description

This function calculates the Cumulative density function (CDF) of the NTLKwIEx distribution.

### Usage

```
C_NTLKwIEx(x, teta, alpha, a, b, m)
```

**Arguments**

x	Value up to which to calculate the CDF.
teta	Parameter teta of the distribution representing the distribution of the inverse exponential component.
alpha	Parameter alpha of the distribution representing the distribution of the new proposal component.
a	Parameter a of the distribution representing the distribution of the Kumaraswamy component.
b	Parameter b of the distribution representing the distribution of the Kumaraswamy component.
m	Parameter m of the distribution representing the distribution of the Topp Leone component.

**Details**

It takes parameters x, teta, alpha, a, b, and m, and returns the CDF value at x based on these parameters. The formula used for the calculation is provided in the documentation header. The Cumulative Distribution Function (CDF) of the NTLKwIEx distribution is defined as:

$$F(x; a, b, m, \alpha, \theta) = \left[ 1 - \left( 1 - K(x, \xi)^{a\alpha^{K(x, \xi)}} \right)^{2b} \right]^m$$

where  $\alpha, a, b, m, \theta > 0$ .

**Value**

Value of the CDF for the NTLKwIEx distribution evaluated at x

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E\_NTLKwIEx

*Estimate parameters with constraints*


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**Description**

This function estimates the parameters of the NTLKwIEx distribution while adhering to parameter constraints. It employs the maximum likelihood estimation method and returns estimated values for each parameter based on a given dataset and the specified constraints.

**Usage**

```
E_NTLKwIEx(data)
```

**Arguments**

data	Numeric vector of data values.
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**Value**

Numeric vector of estimated parameters.

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Plot_CNtLKwIEx	<i>Graphical representation of the Cumulative Distribution Function (CDF) of the NTLKwIEx distribution</i>
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### Description

This function generates a plot of the Cumulative Distribution Function (CDF) of the NTLKwIEx distribution over a specified range of x values.

### Usage

```
Plot_CNtLKwIEx(teta, alpha, a, b, m, min_x, max_x)
```

### Arguments

teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution
min_x	Minimum value of x for the plot
max_x	Maximum value of x for the plot

### Value

A plot of the CDF of the NTLKwIEx distribution

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Plot_PNTLKwIEx	<i>Graphical representation of the probability density function (PDF) of the NTLKwIEx distribution</i>
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### Description

This function generates a graph of the probability density function (PDF) of the NTLKwIEx distribution over a specified range of x values.

### Usage

```
Plot_PNTLKwIEx(teta, alpha, a, b, m, min_x, max_x)
```

**Arguments**

teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution
min_x	Minimum value of x for the graph
max_x	Maximum value of x for the graph

**Value**

A graph of the PDF of the NTLKwIEx distribution

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P\_NTLKwIEx

*Probability Density Function (PDF) of the NTLKwIEx distribution*

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**Description**

The Probability Density Function (PDF) of the NTLKwIEx distribution is defined as:

**Usage**

P\_NTLKwIEx(x, teta, alpha, a, b, m)

**Arguments**

x	Value to evaluate the PDF at
teta	Parameter teta of the distribution
alpha	Parameter alpha of the distribution
a	Parameter a of the distribution
b	Parameter b of the distribution
m	Parameter m of the distribution

**Details**

$$f(x, \theta, \alpha, a, b, m) = 2abm \frac{\theta}{x^2} \left( -\frac{\theta}{x} \log(\alpha) + \exp\left(\frac{\theta}{x}\right) \right) \exp\left\{ -\frac{\theta}{x} \left( 1 + a\alpha^{\exp\left(-\frac{\theta}{x}\right)} \right) \right\} \left\{ 1 - \exp\left( -a\frac{\theta}{x} \alpha^{\exp\left(-\frac{\theta}{x}\right)} \right) \right\}^{2b}$$

**Value**

Value of the PDF for the NTLKwIEx distribution evaluated at x

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Q\_NTLKwIEx                      *Quantile Value of the NTLKwIEx distribution*

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### Description

This function calculates the quantile value of the NTLKwIEx distribution for a given probability  $p$ .

### Usage

Q\_NTLKwIEx( $p$ ,  $teta$ ,  $alpha$ ,  $a$ ,  $b$ ,  $m$ )

### Arguments

$p$	Probability for which the quantile value is to be calculated ( $0 \leq p \leq 1$ )
$teta$	Parameter $teta$ of the distribution
$alpha$	Parameter $alpha$ of the distribution
$a$	Parameter $a$ of the distribution
$b$	Parameter $b$ of the distribution
$m$	Parameter $m$ of the distribution

### Value

The quantile value corresponding to the probability  $p$  for the NTLKwIEx distribution

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R\_NTLKwIEx                      *Random Sampling from the NTLKwIEx distribution*

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### Description

This function generates random samples from the NTLKwIEx distribution based on the given parameters.

### Usage

R\_NTLKwIEx( $n$ ,  $teta$ ,  $alpha$ ,  $a$ ,  $b$ ,  $m$ )

### Arguments

$n$	Number of random samples to generate
$teta$	Parameter $teta$ of the distribution
$alpha$	Parameter $alpha$ of the distribution
$a$	Parameter $a$ of the distribution
$b$	Parameter $b$ of the distribution
$m$	Parameter $m$ of the distribution

**Value**

A vector of n random samples from the NTLKwIEx distribution

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Sim\_NTLKwIEx

*Estimate parameters with constraints*

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**Description**

This function generates a histogram that depicts the distribution of the provided input data. Additionally, it estimates the parameters of a distribution that would correspond to the given data. By overlaying the estimated density function onto the histogram, Sim\_NTLKwIEx enables an immediate comparison between the empirical distribution and the estimated one. Sim\_NTLKwIEx proves to be a valuable tool for initial data exploration, streamlining trend identification, and understanding key features. Its usage comes recommended for tasks that require a swift exploratory analysis of data distributions.

**Usage**

```
Sim_NTLKwIEx(data)
```

**Arguments**

data            Numeric vector of data values.

**Value**

Numeric vector of estimated parameters.

**Examples**

```
Sim_NTLKwIEx(c(38.181, 38.542, 38.928, 39.334, 35.8))
```

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