# Package 'AmoudSurv'

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**Type** Package

**Title** Tractable Parametric Odds-Based Regression Models

**Version** 0.1.0

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**Description** Fits tractable fully parametric odds-based regression models for survival data, including proportional odds (PO), accelerated failure time (AFT), accelerated odds (AO), and General Odds (GO) models in overall survival frameworks. Given at least an R function specifying the survivor, hazard rate and cumulative distribution functions, any user-defined parametric distribution can be fitted. We applied and evaluated a minimum of seventeen (17) various baseline distributions that can handle different failure rate shapes for each of the four different proposed odds-based regression models. For more information see Bennet et al., (1983) <doi:10.1002/sim.4780020223>, and Muse et al., (2022) <doi:10.1016/j.aej.2022.01.033>.

**License** GPL-3

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**LazyData** true

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`alloauto` *Leukemia data set*

---

## Description

The alloauto data frame has 101 rows and 3 columns.

## Format

This data frame contains the following columns:

- time: Time to death or relapse, months
- type :Type of transplant (1=allogeneic, 2=autologous)
- delta:Leukemia-free survival indicator (0=alive without relapse, 1=dead or relapse)

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa,Christophe Chesneau, <abdisalam.hassan@amoud.edu.so>

## Source

Klein and Moeschberger (1997) *Survival Analysis Techniques for Censored and truncated data*, Springer. Kardaun Stat. Nederlandica 37 (1983), 103-126.

## Examples

```
{
data(alloauto)
str(alloauto)
}
```

## bmt *Bone Marrow Transplant (bmt) data set*

### Description

Bone marrow transplant study which is widely used in the hazard-based regression models

### Format

There were 46 patients in the allogeneic treatment and 44 patients in the autologous treatment group

- Time: time to event
- Status: censor indicator, 0 for censored and 1 for uncensored
- TRT: 1 for autologous treatment group; 0 for allogeneic treatment group

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau, <abdisalam.hassan@amoud.edu.so>

### References

Robertson, V. M., Dickson, L. G., Romond, E. H., & Ash, R. C. (1987). Positive antiglobulin tests due to intravenous immunoglobulin in patients who received bone marrow transplant. Transfusion, 27(1), 28-31.

## gastric *Gastric data set*

### Description

The gastric data frame has 90 rows and variables.It is a data set from a clinical trial conducted by the Gastrointestinal Tumor Study Group (GTSG) in 1982. The data set refers to the survival times of patients with locally nonresectable gastric cancer. Patients were either treated with chemotherapy combined with radiation or chemotherapy alone.

### Format

This data frame contains the following columns:

- time: survival times in days
- trt :treatments (1=chemotherapy + radiation; 0=chemotherapy alone)
- status:failure indicator (1=failure, 0=otherwise)

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa,Christophe Chesneau, <abdisalam.hassan@amoud.edu.so>

## Source

Gastrointestinal Tumor Study Group. (1982) A Comparison of Combination Chemotherapy and Combined Modality Therapy for Locally Advanced Gastric Carcinoma. Cancer 49:1771-7.

## Examples

```
{
data(gastric)
str(gastric);head(gastric)
}
```

---

# larynx *Larynx Cancer-Patients data set*

---

## Description

Larynx Cancer-Patients data set which is widely used in the survival regression models

## Format

The data frame contains 90 rows and 5 columns:

- time: time to event, in months
- delta: Censor indicator, 0 alive and 1 for dead
- stage: Stage of disease (1=stage 1, 2=stage2, 3=stage 3, 4=stage 4)
- diagyr: Year of diagnosis of larynx cancer
- age: Age at diagnosis of larynx cancer

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau, <abdisalam.hassan@amoud.edu.so>

## References

Klein and Moeschberger (1997) *Survival Analysis Techniques for Censored and truncated data*, Springer. Kardaun Stat. Nederlandica 37 (1983), 103-126.

MLEAFT *Accelerated Failure Time (AFT) Model.*

## Description

Tractable Parametric accelerated failure time (AFT) model's maximum likelihood estimation, log-likelihood, and information criterion. Baseline hazards: NGLL,GLL,MLL,PGW, GG, EW, MKW, LL, TLL, SLL,CLL,SCLL,ATLL, and ASLL

## Usage

```
MLEAFT(
  init,
  times,
  status,
  n,
  basehaz,
  z,
  method = "BFGS",
  hessian = TRUE,
  conf.int = 0.95,
  maxit = 1000,
  log = FALSE
)
```

## Arguments

| | |
|---|---|
| init | : initial points for optimisation |
| times | : survival times |
| status | : vital status (1 - dead, 0 - alive) |
| n | : The number of the data set |
| basehaz | : baseline hazard structure including baseline (New generalized log-logistic accelerated failure time "NGLLAFT" model, generalized log-logisitic accelerated failure time "GLLAFT" model, modified log-logistic accelerated failure time "MLLAFT" model, exponentiated Weibull accelerated failure time "EWAFT" model, power generalized weibull accelerated failure time "PGWAFT" model, generalized gamma accelerated failure time "GGAFT" model, modified kumaraswamy Weibull proportional odds "MKWAFT" model, log-logistic accelerated failure time "LLAFT" model, tangent-log-logistic accelerated failure time "TLLAFT" model, sine-log-logistic accelerated failure time "SLLAFT" model, cosine log-logistic accelerated failure time "CLLAFT" model, secant-log-logistic accelerated failure time "SCLLAFT" model, arcsine-log-logistic accelerated failure time "ASLLAFT" model, arctangent-log-logistic accelerated failure time "ATLLAFT" model, Weibull accelerated failure time "WAFT" model, gamma accelerated failure time "GAFT", and log-normal accelerated failure time "LNAFT") |

| | |
|---|---|
| z | : design matrix for covariates (p x n), p >= 1 |
| method | :"optim" or a method from "nlminb".The methods supported are: BFGS (default), "L-BFGS", "Nelder-Mead", "SANN", "CG", and "Brent". |
| hessian | :A function to return (as a matrix) the hessian for those methods that can use this information. |
| conf.int | : confidence level |
| maxit | :The maximum number of iterations. Defaults to 1000 |
| log | :log scale (TRUE or FALSE) |

## Value

a list containing the output of the optimisation (OPT) and the log-likelihood function (loglik)

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
#Example #1
data(alloauto)
time<-alloauto$time
delta<-alloauto$delta
z<-alloauto$type
MLEAFT(init = c(1.0,0.20,0.05),times = time,status = delta,n=nrow(z),
basehaz = "WAFT",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,
log=FALSE)

#Example #2
data(bmt)
time<-bmt$Time
delta<-bmt$Status
z<-bmt$TRT
MLEAFT(init = c(1.0,1.0,0.5),times = time,status = delta,n=nrow(z),
basehaz = "LNAFT",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)

#Example #3
data("gastric")
time<-gastric$time
delta<-gastric$status
z<-gastric$trt
MLEAFT(init = c(1.0,0.50,0.5),times = time,status = delta,n=nrow(z),
basehaz = "LLAFT",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,
log=FALSE)

#Example #4
data("larynx")
time<-larynx$time
delta<-larynx$delta
```

```
larynx$age<-as.numeric(scale(larynx$age))
larynx$diagyr<-as.numeric(scale(larynx$diagyr))
larynx$stage<-as.factor(larynx$stage)
z<-model.matrix(~ stage+age+diagyr, data = larynx)
MLEAFT(init = c(1.0,0.5,0.5,0.5,0.5,0.5,0.5,0.5),times = time,status = delta,n=nrow(z),
basehaz = "LNAFT",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,
log=FALSE)
```

---

MLEAO *Accelerated Odds (AO) Model.*

---

## Description

A Tractable Parametric Accelerated Odds (AO) model's maximum likelihood estimates,log-likelihood, and Information Criterion values. Baseline hazards: NGLL,GLL,MLL,PGW, GG, EW, MKW, LL, TLL, SLL,CLL,SCLL,ATLL, and ASLL

## Usage

```
MLEAO(
  init,
  times,
  status,
  n,
  basehaz,
  z,
  method = "BFGS",
  hessian = TRUE,
  conf.int = 0.95,
  maxit = 1000,
  log = FALSE
)
```

## Arguments

| | |
|---|---|
| init | : Initial parameters to maximize the likelihood function; |
| times | : survival times |
| status | : vital status (1 - dead, 0 - alive) |
| n | : The number of the data set |
| basehaz | : baseline hazard structure including baseline (New generalized log-logistic accelerated odds "NGLLAO" model, generalized log-logisitic accelerated odds "GLLAO" model, modified log-logistic accelerated odds "MLLAO" model,exponentiated Weibull accelerated odds "EWAO" model, power generalized weibull accelerated odds "PGWAO" model, generalized gamma accelerated odds "GGAO" model, modified kumaraswamy Weibull accelerated odds "MKWAO" model, |

| | |
|---|---|
| | log-logistic accelerated odds "LLAO" model, tangent-log-logistic accelerated odds "TLLAO" model, sine-log-logistic accelerated odds "SLLAO" model, cosine log-logistic accelerated odds "CLLAO" model,secant-log-logistic accelerated odds "SCLLAO" model, arcsine-log-logistic accelerated odds "ASLLAO" model,arctangent-log-logistic accelerated odds "ATLLAO" model, Weibull accelerated odds "WAO" model, gamma accelerated odds "WAO" model, and log-normal accelerated odds "ATLNAO" model.) |
| z | : design matrix for covariates (p x n), p >= 1 |
| method | :"optim" or a method from "nlminb".The methods supported are: BFGS (default), "L-BFGS", "Nelder-Mead", "SANN", "CG", and "Brent". |
| hessian | :A function to return (as a matrix) the hessian for those methods that can use this information. |
| conf.int | : confidence level |
| maxit | :The maximum number of iterations. Defaults to 1000 |
| log | :log scale (TRUE or FALSE) |

## Value

a list containing the output of the optimisation (OPT) and the log-likelihood function (loglik)

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
#Example #1
data(alloauto)
time<-alloauto$time
delta<-alloauto$delta
z<-alloauto$type
MLEAO(init = c(1.0,0.40,0.50,0.50),times = time,status = delta,n=nrow(z),
basehaz = "GLLAO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)

#Example #2
data(bmt)
time<-bmt$Time
delta<-bmt$Status
z<-bmt$TRT
MLEAO(init = c(1.0,1.0,0.5),times = time,status = delta,n=nrow(z),
basehaz = "CLLAO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,
log=FALSE)

#Example #3
data("gastric")
time<-gastric$time
delta<-gastric$status
z<-gastric$trt
```

```
MLEAO(init = c(1.0,1.0,0.5),times = time,status = delta,n=nrow(z),
basehaz = "LNAO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)

#Example #4
data("larynx")
time<-larynx$time
delta<-larynx$delta
larynx$age<-as.numeric(scale(larynx$age))
larynx$diagyr<-as.numeric(scale(larynx$diagyr))
larynx$stage<-as.factor(larynx$stage)
z<-model.matrix(~ stage+age+diagyr, data = larynx)
MLEAO(init = c(1.0,1.0,0.5,0.5,0.5,0.5,0.5,0.5),times = time,status = delta,n=nrow(z),
basehaz = "ASLLAO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)
```

---

MLEGO *General Odds (GO) Model.*

---

## Description

A Tractable Parametric General Odds (GO) model's Log-likelihood, MLE and information criterion values. Baseline hazards: NGLL,GLL,MLL,PGW, GG, EW, MKW, LL, TLL, SLL,CLL,SCLL,ATLL, and ASLL

## Usage

```
MLEGO(
  init,
  times,
  status,
  n,
  basehaz,
  z,
  zt,
  method = "BFGS",
  hessian = TRUE,
  conf.int = 0.95,
  maxit = 1000,
  log = FALSE
)
```

## Arguments

| | |
|---|---|
| init | : initial points for optimisation |
| times | : survival times |
| status | : vital status (1 - dead, 0 - alive) |
| n | : The number of the data set |

| | |
|---|---|
| basehaz | : baseline hazard structure including baseline (New generalized log-logistic general odds "NGLLGO" model, generalized log-logisitic general odds "GLLGO" model, modified log-logistic general odds "MLLGO" model,exponentiated Weibull general odds "EWGO" model, power generalized weibull general odds "PGWGO" model, generalized gamma general odds "GGGO" model, modified kumaraswamy Weibull general odds "MKWGO" model, log-logistic general odds "LLGO" model, tangent-log-logistic general odds "TLLGO" model, sine-log-logistic general odds "SLLGO" model, cosine log-logistic general odds "CLLGO" model,secant-log-logistic general odds "SCLLGO" model, arcsine-log-logistic general odds "ASLLGO" model, arctangent-log-logistic general odds "ATLLGO" model, Weibull general odds "WGO" model, gamma general odds "WGO" model, and log-normal general odds "ATLNGO" model.) |
| z | : design matrix for odds-level effects (p x n), p >= 1 |
| zt | : design matrix for time-dependent effects (q x n), q >= 1 |
| method | :"optim" or a method from "nlminb".The methods supported are: BFGS (default), "L-BFGS", "Nelder-Mead", "SANN", "CG", and "Brent". |
| hessian | :A function to return (as a matrix) the hessian for those methods that can use this information. |
| conf.int | : confidence level |
| maxit | :The maximum number of iterations. Defaults to 1000 |
| log | :log scale (TRUE or FALSE) |

## Value

a list containing the output of the optimisation (OPT) and the log-likelihood function (loglik)

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
#Example #1
data(alloauto)
time<-alloauto$time
delta<-alloauto$delta
z<-alloauto$type
MLEGO(init = c(1.0,0.50,0.50,0.5,0.5),times = time,status = delta,n=nrow(z),
basehaz = "PGWGO",z = z,zt=z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)

#Example #2
data(bmt)
time<-bmt$Time
delta<-bmt$Status
z<-bmt$TRT
MLEGO(init = c(1.0,0.50,0.45,0.5),times = time,status = delta,n=nrow(z),
basehaz = "TLLGO",z = z,zt=z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,
```

```
log=FALSE)

#Example #3
data("gastric")
time<-gastric$time
delta<-gastric$status
z<-gastric$trt
MLEGO(init = c(1.0,1.0,0.50,0.5,0.5),times = time,status = delta,n=nrow(z),
basehaz = "GLLGO",z = z,zt=z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)
```

---

MLEPO *Proportional Odds (PO) model.*

---

## Description

Tractable Parametric Proportional Odds (PO) model's maximum likelihood estimation, log-likelihood, and information criterion. Baseline hazards: NGLL,GLL,MLL,PGW, GG, EW, MKW, LL, TLL, SLL,CLL,SCLL,ATLL, and ASLL

## Usage

```
MLEPO(
  init,
  times,
  status,
  n,
  basehaz,
  z,
  method = "BFGS",
  hessian = TRUE,
  conf.int = 0.95,
  maxit = 1000,
  log = FALSE
)
```

## Arguments

| | |
|---|---|
| `init` | : initial points for optimisation |
| `times` | : survival times |
| `status` | : vital status (1 - dead, 0 - alive) |
| `n` | : The number of the data set |
| `basehaz` | : baseline hazard structure including baseline (New generalized log-logistic proportional odds "NGLLPO" model, generalized log-logisitic proportional odds "GLLPO" model, modified log-logistic proportional odds "MLLPO" model, exponentiated Weibull proportional odds "EWPO" model, power generalized |

| | |
|---|---|
| | weibull proportional odds "PGWPO" model, generalized gamma proportional odds "GGPO" model, modified kumaraswamy Weibull proportional odds "MK-WPO" model, log-logistic proportional odds "PO" model, tangent-log-logistic proportional odds "TLLPO" model, sine-log-logistic proportional odds "SLLPO" model, cosine log-logistic proportional odds "CLLPO" model, secant-log-logistic proportional odds "SCLLPO" model, arcsine-log-logistic proportional odds "ASLLPO" model, and arctangent-log-logistic proportional odds "ATLLPO" model, Weibull proportional odds "WPO" model, gamma proportional odds "GPO" model, and log-normal proportional odds "LNPO" model.) |
| z | : design matrix for covariates (p x n), p >= 1 |
| method | :"optim" or a method from "nlminb".The methods supported are: BFGS (default), "L-BFGS", "Nelder-Mead", "SANN", "CG", and "Brent". |
| hessian | :A function to return (as a matrix) the hessian for those methods that can use this information. |
| conf.int | : confidence level |
| maxit | :The maximum number of iterations. Defaults to 1000 |
| log | :log scale (TRUE or FALSE) |

## Value

a list containing the output of the optimisation (OPT) and the log-likelihood function (loglik)

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
#Example #1
data(alloauto)
time<-alloauto$time
delta<-alloauto$delta
z<-alloauto$type
MLEPO(init = c(1.0,0.40,1.0,0.50),times = time,status = delta,n=nrow(z),
basehaz = "GLLPO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)

#Example #2
data(bmt)
time<-bmt$Time
delta<-bmt$Status
z<-bmt$TRT
MLEPO(init = c(1.0,1.0,0.5),times = time,status = delta,n=nrow(z),
basehaz = "SLLPO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)

#Example #3
data("gastric")
time<-gastric$time
delta<-gastric$status
```

```
z<-gastric$trt
MLEPO(init = c(1.0,0.50,1.0,0.75),times = time,status = delta,n=nrow(z),
basehaz = "PGWPO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,
log=FALSE)

#Example #4
data("larynx")
time<-larynx$time
delta<-larynx$delta
larynx$age<-as.numeric(scale(larynx$age))
larynx$diagyr<-as.numeric(scale(larynx$diagyr))
larynx$stage<-as.factor(larynx$stage)
z<-model.matrix(~ stage+age+diagyr, data = larynx)
MLEPO(init = c(1.0,1.0,0.5,0.5,0.5,0.5,0.5,0.5),times = time,status = delta,n=nrow(z),
basehaz = "ATLLPO",z = z,method = "BFGS",hessian=TRUE, conf.int=0.95,maxit = 1000,log=FALSE)
```

---

pASLL *Arcsine-Log-logistic (ASLL) Cumulative Distribution Function.*

---

## Description

Arcsine-Log-logistic (ASLL) Cumulative Distribution Function.

## Usage

```
pASLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the ASLL Cumulative Distribution Function.

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Tung, Y. L., Ahmad, Z., & Mahmoudi, E. (2021). The Arcsine-X Family of Distributions with Applications to Financial Sciences. Comput. Syst. Sci. Eng., 39(3), 351-363.

## Examples

```
t=runif(10,min=0,max=1)
pASLL(t=t, alpha=0.7, beta=0.5)
```

---

pATLL *Arctangent-Log-logistic (ATLL) Cumulative Distribution Function.*

---

## Description

Arctangent-Log-logistic (ATLL) Cumulative Distribution Function.

## Usage

```
pATLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the ATLL Cumulative Distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Alkhairy, I., Nagy, M., Muse, A. H., & Hussam, E. (2021). The Arctan-X family of distributions: Properties, simulation, and applications to actuarial sciences. Complexity, 2021.

## Examples

```
t=runif(10,min=0,max=1)
pATLL(t=t, alpha=0.7, beta=0.5)
```

pCLL *Cosine-Log-logistic (SLL) Cumulative Distribution Function.*

## Description

Cosine-Log-logistic (SLL) Cumulative Distribution Function.

## Usage

```
pCLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the CLL Cumulative Distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Souza, L., Junior, W. R. D. O., de Brito, C. C. R., Ferreira, T. A., & Soares, L. G. (2019). General properties for the Cos-G class of distributions with applications. Eurasian Bulletin of Mathematics (ISSN: 2687-5632), 63-79.

## Examples

```
t=runif(10,min=0,max=1)
pCLL(t=t, alpha=0.7, beta=0.5)
```

pdGG *Generalised Gamma (GG) Probability Density Function.*

## Description

Generalised Gamma (GG) Probability Density Function.

## Usage

```
pdGG(t, kappa, alpha, eta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the GG probability density function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pdGG(t=t, kappa=0.5, alpha=0.35, eta=0.9,log=FALSE)
```

pEW *Exponentiated Weibull (EW) Cumulative Distribution Function.*

## Description

Exponentiated Weibull (EW) Cumulative Distribution Function.

## Usage

```
pEW(t, lambda, kappa, alpha, log.p = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| lambda | : scale parameter |
| kappa | : shape parameter |
| alpha | : shape parameter |
| log.p | :log scale (TRUE or FALSE) |

### Value

the value of the EW cumulative distribution function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
pEW(t=t, lambda=0.65,kappa=0.45, alpha=0.25, log.p=FALSE)
```

---

## pG *Gamma (G) Cumulative Distribution Function.*

---

### Description

Gamma (G) Cumulative Distribution Function.

### Usage

```
pG(t, shape, scale)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| shape | : shape parameter |
| scale | : scale parameter |

### Value

the value of the G Cumulative Distribution function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pG(t=t, shape=0.85, scale=0.5)
```

---

pGG *Generalised Gamma (GG) Cumulative Distribution Function.*

---

## Description

Generalised Gamma (GG) Cumulative Distribution Function.

## Usage

```
pGG(t, kappa, alpha, eta, log.p = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log.p | :log scale (TRUE or FALSE) |

## Value

the value of the GG cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pGG(t=t, kappa=0.5, alpha=0.35, eta=0.9,log.p=FALSE)
```

pGLL *Generalized Log-logistic (GLL) cumulative distribution function.*

## Description

Generalized Log-logistic (GLL) cumulative distribution function.

## Usage

```
pGLL(t, kappa, alpha, eta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |

## Value

the value of the GLL cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Muse, A. H., Mwalili, S., Ngesa, O., Almalki, S. J., & Abd-Elmougod, G. A. (2021). Bayesian and classical inference for the generalized log-logistic distribution with applications to survival data. Computational intelligence and neuroscience, 2021.

## Examples

```
t=runif(10,min=0,max=1)
pGLL(t=t, kappa=0.5, alpha=0.35, eta=0.9)
```

pLL *Log-logistic (LL) Cumulative Distribution Function.*

## Description

Log-logistic (LL) Cumulative Distribution Function.

## Usage

```
pLL(t, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |

## Value

the value of the LL cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pLL(t=t, kappa=0.5, alpha=0.35)
```

pLN *Lognormal (LN) Cumulative Distribution Function.*

## Description

Lognormal (LN) Cumulative Distribution Function.

## Usage

```
pLN(t, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : meanlog parameter |
| alpha | : sdlog parameter |

## Value

the value of the LN cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pLN(t=t, kappa=0.75, alpha=0.95)
```

---

# pMKW *Modified Kumaraswamy Weibull (MKW) Cumulative Distribution Function.*

---

## Description

Modified Kumaraswamy Weibull (MKW) Cumulative Distribution Function.

## Usage

```
pMKW(t, alpha, kappa, eta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : Inverse scale parameter |
| kappa | : shape parameter |
| eta | : shape parameter |

## Value

the value of the MKW cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pMKW(t=t,alpha=0.35, kappa=0.7, eta=1.4)
```

pMLL *Modified Log-logistic (MLL) cumulative distribution function.*

## Description

Modified Log-logistic (MLL) cumulative distribution function.

## Usage

```
pMLL(t, kappa, alpha, eta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |

## Value

the value of the MLL cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Kayid, M. (2022). Applications of Bladder Cancer Data Using a Modified Log-Logistic Model. Applied Bionics and Biomechanics, 2022.

## Examples

```
t=runif(10,min=0,max=1)
pMLL(t=t, kappa=0.75, alpha=0.5, eta=0.9)
```

pNGLL *New Generalized Log-logistic (NGLL) cumulative distribution function.*

## Description

New Generalized Log-logistic (NGLL) cumulative distribution function.

## Usage

```
pNGLL(t, kappa, alpha, eta, zeta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| zeta | : shape parameter |

## Value

the value of the NGLL cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Hassan Muse, A. A new generalized log-logistic distribution with increasing, decreasing, unimodal and bathtub-shaped hazard rates: properties and applications, in Proceedings of the Symmetry 2021 - The 3rd International Conference on Symmetry, 8–13 August 2021, MDPI: Basel, Switzerland, doi:10.3390/Symmetry2021-10765.

## Examples

```
t=runif(10,min=0,max=1)
pNGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, zeta=1.4)
```

pPGW *Power Generalised Weibull (PGW) cumulative distribution function.*

## Description

Power Generalised Weibull (PGW) cumulative distribution function.

## Usage

```
pPGW(t, kappa, alpha, eta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |

## Value

the value of the PGW cumulative distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Alvares, D., & Rubio, F. J. (2021). A tractable Bayesian joint model for longitudinal and survival data. Statistics in Medicine, 40(19), 4213-4229.

## Examples

```
t=runif(10,min=0,max=1)
pPGW(t=t, kappa=0.5, alpha=1.5, eta=0.6)
```

pSCLL *Secant-log-logistic (SCLL) Cumulative Distribution Function.*

## Description

Secant-log-logistic (SCLL) Cumulative Distribution Function.

## Usage

```
pSCLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the SCLL Cumulative Distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Souza, L., de Oliveira, W. R., de Brito, C. C. R., Chesneau, C., Fernandes, R., & Ferreira, T. A. (2022). Sec-G class of distributions: Properties and applications. Symmetry, 14(2), 299.

## Examples

```
t=runif(10,min=0,max=1)
pSCLL(t=t, alpha=0.7, beta=0.5)
```

pSLL *Sine-Log-logistic (SLL) Cumulative Distribution Function.*

## Description

Sine-Log-logistic (SLL) Cumulative Distribution Function.

## Usage

```
pSLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the SLL Cumulative Distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Souza, L., Junior, W., De Brito, C., Chesneau, C., Ferreira, T., & Soares, L. (2019). On the Sin-G class of distributions: theory, model and application. Journal of Mathematical Modeling, 7(3), 357-379.

## Examples

```
t=runif(10,min=0,max=1)
pSLL(t=t, alpha=0.7, beta=0.5)
```

pTLL *Tangent-Log-logistic (TLL) Cumulative Distribution Function.*

## Description

Tangent-Log-logistic (TLL) Cumulative Distribution Function.

## Usage

```
pTLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the TLL Cumulative Distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pTLL(t=t, alpha=0.7, beta=0.5)
```

pW *Weibull (W) Cumulative Distribution Function.*

## Description

Weibull (W) Cumulative Distribution Function.

## Usage

```
pW(t, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |

## Value

the value of the W Cumulative Distribution function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
pW(t=t, kappa=0.75, alpha=0.5)
```

---

# rASLL *Arcsine-Log-logistic (ASLL) Hazard Rate Function.*

---

## Description

Arcsine-Log-logistic (ASLL) Hazard Rate Function.

## Usage

```
rASLL(t, alpha, beta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the ASLL Hazard Rate Function.

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
rSLL(t=t, alpha=0.7, beta=0.5,log=FALSE)
```

rATLL *Arctangent-Log-logistic (ATLL) Hazard Function.*

## Description

Arctangent-Log-logistic (ATLL) Hazard Function.

## Usage

```
rATLL(t, alpha, beta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the ATLL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
rATLL(t=t, alpha=0.7, beta=0.5,log=FALSE)
```

rCLL *Cosine-Log-logistic (CLL) Hazard Function.*

## Description

Cosine-Log-logistic (CLL) Hazard Function.

## Usage

```
rCLL(t, alpha, beta, log = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

### Value

the value of the CLL hazard function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### References

Souza, L., Junior, W. R. D. O., de Brito, C. C. R., Ferreira, T. A., & Soares, L. G. (2019). General properties for the Cos-G class of distributions with applications. Eurasian Bulletin of Mathematics (ISSN: 2687-5632), 63-79.

### Examples

```
t=runif(10,min=0,max=1)
rCLL(t=t, alpha=0.7, beta=0.5,log=FALSE)
```

---

## rEW *Exponentiated Weibull (EW) Hazard Function.*

---

### Description

Exponentiated Weibull (EW) Hazard Function.

### Usage

```
rEW(t, lambda, kappa, alpha, log = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| lambda | : scale parameter |
| kappa | : shape parameter |
| alpha | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the EW hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Khan, S. A. (2018). Exponentiated Weibull regression for time-to-event data. Lifetime data analysis, 24(2), 328-354.

## Examples

```
t=runif(10,min=0,max=1)
rEW(t=t, lambda=0.9, kappa=0.5, alpha=0.75, log=FALSE)
```

---

# rG *Gamma (G) Hazard Function.*

---

## Description

Gamma (G) Hazard Function.

## Usage

```
rG(t, shape, scale, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| shape | : shape parameter |
| scale | : scale parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the G hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
rG(t=t, shape=0.5, scale=0.85,log=FALSE)
```

rGG *Generalised Gamma (GG) Hazard Function.*

## Description

Generalised Gamma (GG) Hazard Function.

## Usage

```
rGG(t, kappa, alpha, eta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the GG hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Agarwal, S. K., & Kalla, S. L. (1996). A generalized gamma distribution and its application in reliabilty. Communications in Statistics-Theory and Methods, 25(1), 201-210.

## Examples

```
t=runif(10,min=0,max=1)
rGG(t=t, kappa=0.5, alpha=0.35, eta=0.9,log=FALSE)
```

rGLL *Generalized Log-logistic (GLL) hazard function.*

## Description

Generalized Log-logistic (GLL) hazard function.

## Usage

```
rGLL(t, kappa, alpha, eta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the GLL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Muse, A. H., Mwalili, S., Ngesa, O., Alshanbari, H. M., Khosa, S. K., & Hussam, E. (2022). Bayesian and frequentist approach for the generalized log-logistic accelerated failure time model with applications to larynx-cancer patients. Alexandria Engineering Journal, 61(10), 7953-7978.

## Examples

```
t=runif(10,min=0,max=1)
rGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, log=FALSE)
```

rLL *Log-logistic (LL) Hazard Function.*

## Description

Log-logistic (LL) Hazard Function.

## Usage

```
rLL(t, kappa, alpha, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the LL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
rLL(t=t, kappa=0.5, alpha=0.35,log=FALSE)
```

rLN *Lognormal (LN) Hazard Function.*

## Description

Lognormal (LN) Hazard Function.

## Usage

```
rLN(t, kappa, alpha, log = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : meanlog parameter |
| alpha | : sdlog parameter |
| log | :log scale (TRUE or FALSE) |

### Value

the value of the LN hazard function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
rLN(t=t, kappa=0.5, alpha=0.75,log=FALSE)
```

---

## rMKW *Modified Kumaraswamy Weibull (MKW) Hazard Function.*

---

### Description

Modified Kumaraswamy Weibull (MKW) Hazard Function.

### Usage

```
rMKW(t, alpha, kappa, eta, log = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : inverse scale parameter |
| kappa | : shape parameter |
| eta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

### Value

the value of the MKW hazard function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Khosa, S. K. (2019). Parametric Proportional Hazard Models with Applications in Survival analysis (Doctoral dissertation, University of Saskatchewan).

## Examples

```
t=runif(10,min=0,max=1)
rMKW(t=t, alpha=0.35, kappa=0.7, eta=1.4, log=FALSE)
```

---

# rMLL *Modified Log-logistic (MLL) hazard function.*

---

## Description

Modified Log-logistic (MLL) hazard function.

## Usage

```
rMLL(t, kappa, alpha, eta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the MLL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
rMLL(t=t, kappa=0.75, alpha=0.5, eta=0.9,log=FALSE)
```

rNGLL *New Generalized Log-logistic (NGLL) hazard function.*

## Description

New Generalized Log-logistic (NGLL) hazard function.

## Usage

```
rNGLL(t, kappa, alpha, eta, zeta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| zeta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the NGLL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
rNGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, zeta=1.4, log=FALSE)
```

rPGW *Power Generalised Weibull (PGW) hazard function.*

## Description

Power Generalised Weibull (PGW) hazard function.

## Usage

```
rPGW(t, kappa, alpha, eta, log = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

### Value

the value of the PGW hazard function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
rPGW(t=t, kappa=0.5, alpha=1.5, eta=0.6,log=FALSE)
```

---

## rSCLL *Secant-log-logistic (SCLL) Hazard Function.*

---

### Description

Secant-log-logistic (SCLL) Hazard Function.

### Usage

```
rSCLL(t, alpha, beta, log = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

### Value

the value of the SCLL hazard function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Souza, L., de Oliveira, W. R., de Brito, C. C. R., Chesneau, C., Fernandes, R., & Ferreira, T. A. (2022). Sec-G class of distributions: Properties and applications. Symmetry, 14(2), 299.

Tung, Y. L., Ahmad, Z., & Mahmoudi, E. (2021). The Arcsine-X Family of Distributions with Applications to Financial Sciences. Comput. Syst. Sci. Eng., 39(3), 351-363.

## Examples

```
t=runif(10,min=0,max=1)
rSCLL(t=t, alpha=0.7, beta=0.5,log=FALSE)
```

---

`rSLL` *Sine-Log-logistic (SLL) Hazard Function.*

---

## Description

Sine-Log-logistic (SLL) Hazard Function.

## Usage

```
rSLL(t, alpha, beta, log = FALSE)
```

## Arguments

| | |
|---|---|
| `t` | : positive argument |
| `alpha` | : scale parameter |
| `beta` | : shape parameter |
| `log` | :log scale (TRUE or FALSE) |

## Value

the value of the SLL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Souza, L. (2015). New trigonometric classes of probabilistic distributions. esis, Universidade Federal Rural de Pernambuco, Brazil.

## Examples

```
t=runif(10,min=0,max=1)
rSLL(t=t, alpha=0.7, beta=0.5,log=FALSE)
```

rTLL *Tangent-Log-logistic (TLL) Hazard Function.*

## Description

Tangent-Log-logistic (TLL) Hazard Function.

## Usage

```
rTLL(t, alpha, beta, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the TLL hazard function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Muse, A. H., Tolba, A. H., Fayad, E., Abu Ali, O. A., Nagy, M., & Yusuf, M. (2021). Modelling the COVID-19 mortality rate with a new versatile modification of the log-logistic distribution. Computational Intelligence and Neuroscience, 2021.

## Examples

```
t=runif(10,min=0,max=1)
rTLL(t=t, alpha=0.7, beta=0.5,log=FALSE)
```

rW *Weibull (W) Hazard Function.*

## Description

Weibull (W) Hazard Function.

## Usage

```
rW(t, kappa, alpha, log = FALSE)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| log | :log scale (TRUE or FALSE) |

## Value

the value of the w hazard function

## Author(s)

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## Examples

```
t=runif(10,min=0,max=1)
rW(t=t, kappa=0.75, alpha=0.5,log=FALSE)
```

sASLL *Arcsine-Log-logistic (ASLL) Survival Function.*

## Description

Arcsine-Log-logistic (ASLL) Survival Function.

## Usage

```
sASLL(t, alpha, beta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

### Value

the value of the ASLL Survival Function.

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### References

Tung, Y. L., Ahmad, Z., & Mahmoudi, E. (2021). The Arcsine-X Family of Distributions with Applications to Financial Sciences. Comput. Syst. Sci. Eng., 39(3), 351-363.

### Examples

```
t=runif(10,min=0,max=1)
sASLL(t=t, alpha=0.7, beta=0.5)
```

---

## sATLL *Arctangent-Log-logistic (ATLL) Survivor Function.*

---

### Description

Arctangent-Log-logistic (ATLL) Survivor Function.

### Usage

```
sATLL(t, alpha, beta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

### Value

the value of the ATLL Survivor function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Alkhairy, I., Nagy, M., Muse, A. H., & Hussam, E. (2021). The Arctan-X family of distributions: Properties, simulation, and applications to actuarial sciences. Complexity, 2021.

## Examples

```
t=runif(10,min=0,max=1)
sATLL(t=t, alpha=0.7, beta=0.5)
```

---

sCLL *Cosine-Log-logistic (CLL) Survivor Function.*

---

## Description

Cosine-Log-logistic (CLL) Survivor Function.

## Usage

```
sCLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the CLL Survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Mahmood, Z., M Jawa, T., Sayed-Ahmed, N., Khalil, E. M., Muse, A. H., & Tolba, A. H. (2022). An Extended Cosine Generalized Family of Distributions for Reliability Modeling: Characteristics and Applications with Simulation Study. Mathematical Problems in Engineering, 2022.

## Examples

```
t=runif(10,min=0,max=1)
sCLL(t=t, alpha=0.7, beta=0.5)
```

sEW *Exponentiated Weibull (EW) Survivor Function.*

## Description

Exponentiated Weibull (EW) Survivor Function.

## Usage

```
sEW(t, lambda, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| lambda | : scale parameter |
| kappa | : shape parameter |
| alpha | : shape parameter |

## Value

the value of the EW survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Rubio, F. J., Remontet, L., Jewell, N. P., & Belot, A. (2019). On a general structure for hazard-based regression models: an application to population-based cancer research. Statistical methods in medical research, 28(8), 2404-2417.

## Examples

```
t=runif(10,min=0,max=1)
sEW(t=t, lambda=0.9, kappa=0.5, alpha=0.75)
```

## sG *Gamma (G) Survivor Function.*

### Description

Gamma (G) Survivor Function.

### Usage

```
sG(t, shape, scale)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| shape | : shape parameter |
| scale | : scale parameter |

### Value

the value of the G Survivor function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
sG(t=t, shape=0.85, scale=0.5)
```

## sGG *Generalised Gamma (GG) Survival Function.*

### Description

Generalised Gamma (GG) Survival Function.

### Usage

```
sGG(t, kappa, alpha, eta, log.p = FALSE)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| log.p | :log scale (TRUE or FALSE) |

### Value

the value of the GG survival function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
sGG(t=t, kappa=0.5, alpha=0.35, eta=0.9,log.p=FALSE)
```

---

## sGLL *Generalized Log-logistic (GLL) survivor function.*

---

### Description

Generalized Log-logistic (GLL) survivor function.

### Usage

```
sGLL(t, kappa, alpha, eta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |

### Value

the value of the GLL survivor function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Muse, A. H., Mwalili, S., Ngesa, O., Alshanbari, H. M., Khosa, S. K., & Hussam, E. (2022). Bayesian and frequentist approach for the generalized log-logistic accelerated failure time model with applications to larynx-cancer patients. Alexandria Engineering Journal, 61(10), 7953-7978.

## Examples

```
t=runif(10,min=0,max=1)
sGLL(t=t, kappa=0.5, alpha=0.35, eta=0.9)
```

---

# sLL *Log-logistic (LL) Survivor Function.*

---

## Description

Log-logistic (LL) Survivor Function.

## Usage

```
sLL(t, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |

## Value

the value of the LL survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
sLL(t=t, kappa=0.5, alpha=0.35)
```

sLN *Lognormal (LN) Survivor Hazard Function.*

## Description

Lognormal (LN) Survivor Hazard Function.

## Usage

```
sLN(t, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : meanlog parameter |
| alpha | : sdlog parameter |

## Value

the value of the LN Survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
sLN(t=t, kappa=0.75, alpha=0.95)
```

sMKW *Modified Kumaraswamy Weibull (MKW) Survivor Function.*

## Description

Modified Kumaraswamy Weibull (MKW) Survivor Function.

## Usage

```
sMKW(t, alpha, kappa, eta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : Inverse scale parameter |
| kappa | : shape parameter |
| eta | : shape parameter |

### Value

the value of the MKW survivor function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
sMKW(t=t,alpha=0.35, kappa=0.7, eta=1.4)
```

---

## sMLL *Modified Log-logistic (MLL) survivor function.*

---

### Description

Modified Log-logistic (MLL) survivor function.

### Usage

```
sMLL(t, kappa, alpha, eta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |

### Value

the value of the MLL survivor function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Kayid, M. (2022). Applications of Bladder Cancer Data Using a Modified Log-Logistic Model. Applied Bionics and Biomechanics, 2022.

## Examples

```
t=runif(10,min=0,max=1)
sMLL(t=t, kappa=0.75, alpha=0.5, eta=0.9)
```

---

SNGLL *New Generalized Log-logistic (NGLL) survivor function.*

---

## Description

New Generalized Log-logistic (NGLL) survivor function.

## Usage

```
SNGLL(t, kappa, alpha, eta, zeta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |
| zeta | : shape parameter |

## Value

the value of the NGLL survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Hassan Muse, A. A new generalized log-logistic distribution with increasing, decreasing, unimodal and bathtub-shaped hazard rates: properties and applications, in Proceedings of the Symmetry 2021 - The 3rd International Conference on Symmetry, 8–13 August 2021, MDPI: Basel, Switzerland, doi:10.3390/Symmetry2021-10765.

## Examples

```
t=runif(10,min=0,max=1)
SNGLL(t=t, kappa=0.5, alpha=0.35, eta=0.7, zeta=1.4)
```

sPGW *Power Generalised Weibull (PGW) survivor function.*

## Description

Power Generalised Weibull (PGW) survivor function.

## Usage

```
sPGW(t, kappa, alpha, eta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |
| eta | : shape parameter |

## Value

the value of the PGW survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Alvares, D., & Rubio, F. J. (2021). A tractable Bayesian joint model for longitudinal and survival data. Statistics in Medicine, 40(19), 4213-4229.

## Examples

```
t=runif(10,min=0,max=1)
sPGW(t=t, kappa=0.5, alpha=1.5, eta=0.6)
```

## sSCLL *Secant-log-logistic (SCLL) Survivor Function.*

### Description

Secant-log-logistic (SCLL) Survivor Function.

### Usage

```
sSCLL(t, alpha, beta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

### Value

the value of the SCLL Survivor function

### Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

### Examples

```
t=runif(10,min=0,max=1)
sSCLL(t=t, alpha=0.7, beta=0.5)
```

## sSLL *Sine-Log-logistic (SLL) Survivor Function.*

### Description

Sine-Log-logistic (SLL) Survivor Function.

### Usage

```
sSLL(t, alpha, beta)
```

### Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the SLL Survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## References

Souza, L., Junior, W., De Brito, C., Chesneau, C., Ferreira, T., & Soares, L. (2019). On the Sin-G class of distributions: theory, model and application. Journal of Mathematical Modeling, 7(3), 357-379.

## Examples

```
t=runif(10,min=0,max=1)
sSLL(t=t, alpha=0.7, beta=0.5)
```

---

# sTLL *Tangent-Log-logistic (TLL) Survivor Function.*

---

## Description

Tangent-Log-logistic (TLL) Survivor Function.

## Usage

```
sTLL(t, alpha, beta)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| alpha | : scale parameter |
| beta | : shape parameter |

## Value

the value of the TLL Survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
sTLL(t=t, alpha=0.7, beta=0.5)
```

sW *Weibull (W) Survivor Function.*

## Description

Weibull (W) Survivor Function.

## Usage

```
sW(t, kappa, alpha)
```

## Arguments

| | |
|---|---|
| t | : positive argument |
| kappa | : scale parameter |
| alpha | : shape parameter |

## Value

the value of the W Survivor function

## Author(s)

Abdisalam Hassan Muse, Samuel Mwalili, Oscar Ngesa, Christophe Chesneau <abdisalam.hassan@amoud.edu.so>

## Examples

```
t=runif(10,min=0,max=1)
sW(t=t, kappa=0.75, alpha=0.5)
```

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