Package 'rhosp'

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Title Side Effect Risks in Hospital : Simulation and Estimation

Version 1.10

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Description Evaluating risk (that a patient arises a side effect) during hospitalization is the main purpose of this package. Several methods (Parametric, non parametric and De Vielder estimation) to estimate the risk constant (R) are implemented in this package. There are also functions to simulate the different models of this issue in order to quantify the previous estimators. It is necessary to read at least the first six pages of the report to understand the topic.

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NeedsCompilation no

Repository CRAN

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R topics documented:

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adequadExp *test the adequation of a random variable to the exponential distribution*

Description

In order to test the adequation of a random variable, this function plot the probabilit plot with reference distribution exponential of the variable and calculates the Kolmogorov Smirnov test.

Usage

```
adequadExp(T, toplot = FALSE)
```

Arguments

T	the random variable on which we want to test the adequation
toplot	a logical to plot the probability graph

Value

a list of the following components

`LinearRegression`
: the result of the linear regression of the ordinate on the abcisse of the probability plot

`KolmogorvSmirnovTest`
: the result of the Kolmogorvo Smirnoc test

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
## Not run:
T <- c(12.9622796,  1.4146460,  1.3146761, 14.9147353,  7.5131105,
8.5130874, 6.5943351, 10.6954653, 14.1000977, 12.4673316,  2.7185478,
9.6297777, 10.0930441,  0.6270543, 26.7937074,  7.6082447)
adequadExp(T,TRUE)

## End(Not run)
```

calcErrorDV *compute the bias, variance of the De Vielder approximation*

Description

calcErrorDV computes the risk constant R with the *De Vielder* estimator and its bias and variance.

Usage

```
calcErrorDV(file, nb = 10, disXi, disP, plot = TRUE)
```

Arguments

file	the file in which the simulated data will be stored
nb	the number of simulation
disXi	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
disP	the side effect probability (success probability of Zi) p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters
plot	a logical variable to plot the variable Zi

Value

a list of the following components

bias	the bias of this estimator
var	the variance of this estimator
R	the risk constant estimated
CR	the CR risk constant calculated with R

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
## Not run:
arg1Exp<-list(rangen=rexp,nbparam=1,param=list(1/3));
arg2Exp<-list(disfun=pexp,nbparam=1,param=list(1/5));
res<-calcErrorDV("data.rda",25,arg1Exp,arg2Exp,TRUE)

## End(Not run)
```

`calcErrorNonParam` *compute the bias, variance of the non parametric estimator*

Description

calcErrorNonParam computes the risk constant R with the non parametric estimator and its bias and variance.

Usage

```
calcErrorNonParam(file, nb = 10, disXi, disP, plot = TRUE)
```

Arguments

`file`	the file in which the simulated data will be stored
`nb`	the number of simulation
`disXi`	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
`disP`	the side effect probability (success probability of Zi) p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters
`plot`	a logical variable to plot the variable Zi

Value

a list of the following components

`bias`	the bias of this estimator
`var`	the variance of this estimator
`R`	the risk constant estimated
`CR`	the CR risk constant calculated with R

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#arg1Exp<-list(rangen=rexp,nbparam=1,param=list(1/3));
#arg2Exp<-list(disfun=pexp,nbparam=1,param=list(1/5));


#res<-calcErrorNonParam("data.rda",25,arg1Exp,arg2Exp,TRUE)
```

`calcErrorParam` *compute the bias, variance of the non parametric estimator*

Description

calcErrorNonParam computes the risk constant R with the non parametric estimator and its bias and variance.

Usage

```
calcErrorParam(file, nb = 10, disXi, disP, plot = TRUE)
```

Arguments

`file`	the file in which the simulated data will be stored
`nb`	the number of simulation
`disXi`	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
`disP`	the side effect probability (success probability of Zi) p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters
`plot`	a logical variable to plot the variable Zi

Value

a list of the following components

`bias`	the bias of this estimator
`var`	the variance of this estimator
`R`	the risk constant estimated
`CR`	the CR risk constant calculated with R

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#arg1Exp<-list(rangen=rexp,nbparam=1,param=list(1/3));
#arg2Exp<-list(disfun=pexp,nbparam=1,param=list(1/5));


#res<-calcErrorNonParam("data.rda",25,arg1Exp,arg2Exp,TRUE)
```

DV *implements the De Vielder approximation*

Description

DV computes the De Vielder approximation whose goal is to identify the first two moments of a general case of the first model where p(x) is unknown to the first two moments of the specific case of the first model where $p(x) = 1 - exp(-mu * x)$

Usage

```
DV(T)
```

Arguments

T	a vector of the observations of the random variable T associated with the first model

Value

a vector of lambda and mu of the De Vielder method

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
T<-c(12.9622796,  1.4146460,  1.3146761, 14.9147353,  7.5131105,
8.5130874, 6.5943351, 10.6954653, 14.1000977, 12.4673316,  2.7185478,
9.6297777, 10.0930441,  0.6270543, 26.7937074,  7.6082447)
res<-DV(T)
```

estimDV *compute the De Vielder estimator*

Description

compute the De Vielder estimator, in other words, do the same function as DV but returns more details about this estimator whereas DV only compute the lambda and mu of the De Vielder method

Usage

```
estimDV(fileName, toplot = TRUE, header = TRUE, ks = FALSE)
```

Arguments

fileName	the file in which the simulated data will be stored
toplot	a logical variable to plot the result of this estimation
header	a logical for : has the input file an header
ks	a logical for : do you want the Kolmogorv Smirnov test

Value

a list of the following components

CR	the CR risk constant calculated with the value of R
R	the risk constant estimated by this estimation
T	the vector of observations of the random variable T
lambdaHat	the best estimation of lambda
muHat	the best estimation of mu
lambdaEmp	the estimation of the lambda of the De Vielder method (in this case the same value as lambdaHat)
muEmp	the estimation of the mu of the De Vielder method (in this case the same value as mu)

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#res<-estimDV("data.rda",TRUE,TRUE)
```

---

estimNonParam *compute the parametric estimation*

Description

estimParam compute the parametric estimation of the first model on the input file containing the stay duration Xi and the side effect reporting Zi. this estimator of R (and not mu) is the smallest root of the equation $(*) : P(Zi = 0)E[exp(-RXi)/Zi = 0] = 1$

Usage

```
estimNonParam(fileName, toplot = TRUE, header = TRUE, ks = FALSE, DV = FALSE)
```

Arguments

fileName	the file in which the simulated data will be stored
toplot	a logical variable to plot the result of this estimation
header	a logical for : has the input file an header
ks	a logical for : do you want the Kolmogorv Smirnov test
DV	a logical for : do you want to calculate the De Vielder estimation

Value

a list of the following components

CR	the CR risk constant calculated with the value of R
R	the risk constant estimated by this estimation
T	the vector of observations of the random variable T
lambdaHat	the best estimation of lambda : the ESBVM of lambda
muHat	not available with this estimation
lambdaEmp	the estimation of the lambda of the De Vielder method (only available if DV=TRUE and if there is no problem with De Vielder method)
muEmp	the estimation of the mu of the De Vielder method (only available if DV=TRUE)

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#res<-estimDV("data.rda",TRUE,TRUE)
```

---

estimParam *compute the parametric estimation*

Description

estimParam compute the parametric estimation of the first model on the input file containing the stay duration Xi and the side effect reporting Zi. this estimator of mu is the estimator of maximum likelihood of the random variable $Zi/Xi = x$. the risk constant R is given by the equation (star) $R = mu$.

Usage

```
estimParam(fileName, toplot = TRUE, header = TRUE, ks = FALSE, DV = FALSE)
```

Arguments

fileName	the file in which the simulated data will be stored
toplot	a logical variable to plot the result of this estimation
header	a logical for : has the input file an header
ks	a logical for : do you want the Kolmogorv Smirnov test
DV	a logical for : do you want to calculate the De Vielder estimation

Value

a list of the following components

CR	the CR risk constant calculated with the value of R
R	the risk constant estimated by this estimation
T	the vector of observations of the random variable T
lambdaHat	the best estimation of lambda : the ESBVM of lambda
muHat	the best estimation of mu : the value of mu which maximize the loglikelihood
lambdaEmp	the estimation of the lambda of the De Vielder method (only available if DV=TRUE and if there is no problem with De Vielder method)
muEmp	the estimation of the mu of the De Vielder method (only available if DV=TRUE)

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#res<-estimDV("data.rda",TRUE,TRUE)
```

---

histo *plot the histogram of the variable T*

Description

plot of the random variable T and the equivalent function ($t-> CR*exp(-R*t)$). in some cases, there are also plotted the theoretical and the De Vielder functions

Usage

```
histo(X, disXi = NULL, disP = NULL, plotDV = FALSE)
```

Arguments

X	a list with the following components : T the observation of the random variable ; R the risk constant (estimated or theoretical calculated) ; CR the risk constand deduced from R ; lambdaEmp the estimation of the lambda of the De Vielder method (only available if DV=TRUE and if there is no problem with De Vielder method) ; muEmp the estimation of the mu of the De Vielder method (only available if DV=TRUE); lambdaHat the best estimation of lambda : the ESBVM of lambda ; muHat the best estimation of mu : the value of mu which maximize the loglikelihood (only available if the parametric estimation has been done)
disXi	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
disP	he side effect probability (success probability of Zi) p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters
plotDV	a logical for : do you want to plot the De Vielder "function"

Value

a NULL object.

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#use mainSimul to make the first argument
arg1Exp <- list(rangen=rexp,nbparam=1,param=list(1/3));
arg1Bin <- list(rangen=rbinom,nbparam=2,param=list(1,1/20));
arg1Unif <- list(rangen=runif,nbparam=2,param=list(0,20));
arg1Lnorm <- list(rangen=rlnorm,nbparam=2,param=list(1/4,1));

arg2Exp <- list(disfun=pexp,nbparam=1,param=list(1/5));
arg2Cst <- list(disfun=pcst <- function(x,p) p ,nbparam=1,param=list(1/3));
arg2Comp <- list(disfun=pcomp <- function(x,mu1,mu2,mu3)
{1-1/3*exp(-mu1* x)-1/2*exp(-mu2 *x)-1/6*exp(-mu3 *x)}
,nbparam=3,param=list(1/3,1/5,1/10));
arg2Gamma <- list(disfun=pgamma,nbparam=2,param=list(3,1/3));
arg2Lnorm <- list(disfun=plnorm,nbparam=2,param=list(1/20,2));

T <- mainSimul(100,100,arg1Exp,arg2Exp)

histo(T,arg1Exp,arg2Exp)
```

KM *plots a survival function with a Kaplan Meier variant*

Description

plots the survival function of patients knowing censored data. Model : a variant of Kaplan-Meier's model

Usage

```
KM(fileName, toplot = TRUE, header = TRUE)
```

Arguments

fileName	the file with the data use
toplot	a logical variable to plot the result of this estimation
header	a logical for : has the input file an header

Value

No values returned, just plot the survival function and the theoretical distribution of our model with exponential stays and a constant side effect probability

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#KM("data.rda",TRUE,TRUE)
```

mainSimul *simulate many times the first model and calculate the risk constant*

Description

main simulates nbBed times the first model with the function simul and calculates the risk constant R and CR by solving the renewal equation (star). this renewal equation is only valid if the Xi forms a poisson process. R and CR are defined such that the equivalent survival function is $CR*exp(-R*x)$.

Usage

```
mainSimul(nbBed, nbPatient, disXi, disP, toplot = FALSE, calc = TRUE)
```

Arguments

nbBed	the number of beds
nbPatient	the number of patient in each bed
disXi	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
disP	the distribution of the success probability of Zi : p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters
toplot	a logical variable to plot the variable Zi
calc	should the risk constants calculate?

Details

make simulation and estimation on the sample

Value

Describe the value returned If it is a LIST, use

CR	CR constant used in the exponential bound
R	the risk constant
T	the vector of durations between two declared side effects
lambdaEmp	estimate of lambda
muEmp	estimate of mu

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
arg1Exp <- list(rangen=rexp,nbparam=1,param=list(1/3));
arg1Bin <- list(rangen=rbinom,nbparam=2,param=list(1,1/20));
arg1Unif <- list(rangen=runif,nbparam=2,param=list(0,20));
arg1Lnorm <- list(rangen=rlnorm,nbparam=2,param=list(1/4,1));

arg2Exp <- list(disfun=pexp,nbparam=1,param=list(1/5));
arg2Cst <- list(disfun=pcst <- function(x,p) p ,nbparam=1,param=list(1/3));
arg2Comp <- list(disfun=pcomp <- function(x,mu1,mu2,mu3)
{1-1/3*exp(-mu1* x)-1/2*exp(-mu2 *x)-1/6*exp(-mu3 *x)}
,nbparam=3,param=list(1/3,1/5,1/10));
arg2Gamma <- list(disfun=pgamma,nbparam=2,param=list(3,1/3));
arg2Lnorm <- list(disfun=plnorm,nbparam=2,param=list(1/20,2));

T <- mainSimul(100,100,arg1Exp,arg2Exp)
```

`mainSimul2` *simulate many times the second model*

Description

main simulates nbBed times the second model with the function simul

Usage

```
mainSimul2(nbBed, nbPatient, disXi, disYi, toplot = FALSE)
```

Arguments

`nbBed`	the number of beds
`nbPatient`	the number of patient in each bed
`disXi`	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
`disYi`	the distribution of the variable Yi : disYi is a 3 elements list : rangen for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
`toplot`	a logical variable to plot the variable Zi

Details

If necessary, more details than the description above

Value

return a list of the following components

`T`	T the vector of durations between two declared side effects
`R`	R a risk constant
`CR`	CR a risk constant

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
arg1ExpMod2 <- list(rangen=rexp,nbparam=1,param=list(1/2));
arg1BinMod2 <- list(rangen=rbinom,nbparam=2,param=list(1,1/20));
arg1UnifMod2 <- list(rangen=runif,nbparam=2,param=list(0,20));
arg1LnormMod2 <- list(rangen=rlnorm,nbparam=2,param=list(1/4,1));
```

```
arg2ExpMod2 <- list(rangen=rexp,nbparam=1,param=list(1/5));
# arg2-cst <- list(rangen=pcst <- function(x,p) p ,nbparam=1,param=list(1/10));
arg2GammaMod2 <- list(rangen=rgamma,nbparam=2,param=list(3,1/5));

T <- mainSimul2(100,100,arg1ExpMod2,arg2ExpMod2)
```

`makeSample` *create a sample of the first model stored in a file*

Description

make a sample of the first model, that is to say simulate the sequence of the random variables Xi (stay duration) and the sequence of Zi (side effect reporting)

Usage

```
makeSample(file, nbPatient, disXi, disP)
```

Arguments

`file`	the filename in which the simulation will be stored
`nbPatient`	the number of patients for the simulation
`disXi`	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
`disP`	the side effect probability (success probability of Zi) p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters

Value

a NULL object.

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
arg1Exp<-list(rangen=rexp,nbparam=1,param=list(1/3));

arg2Exp<-list(disfun=pexp,nbparam=1,param=list(1/5));

makeSample("mydata.rda",200,arg1Exp,arg2Exp)
```

makeSample2 *create a sample of the second model stored in a file*

Description

make a sample of the first model, that is to say simulate the sequence of the random variables Xi (stay duration) the sequence of Yi (exposure time) and the sequence of Zi (side effect reporting)

Usage

```
makeSample2(file, nbPatient, disXi, disYi)
```

Arguments

file	the filename in which the simulation will be stored
nbPatient	the number of patients for the simulation
disXi	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
disYi	the distribution of the variable Yi : disYi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters

Value

a NULL object.

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
arg1ExpMod2<-list(rangen=rexp,nbparam=1,param=list(1/2));
arg1BinMod2<-list(rangen=rbinom,nbparam=2,param=list(1,1/20));
arg1UnifMod2<-list(rangen=runif,nbparam=2,param=list(0,20));
arg1LnormMod2<-list(rangen=rlnorm,nbparam=2,param=list(1/4,1));

arg2ExpMod2<-list(rangen=rexp,nbparam=1,param=list(1/5));
# arg2-cst<-list(rangen=pcst<-function(x,p) p ,nbparam=1,param=list(1/10));
arg2GammaMod2<-list(rangen=rgamma,nbparam=2,param=list(3,1/5));


makeSample2("thedata.rda",200,arg1ExpMod2,arg2ExpMod2)
```

simul *simulate the first model of the hospital risk*

Description

simul simulate the first model of the hospital that is to say simulating the sequence of variables Xi (which follow the disxi distribution passed as an argument) and the sequence of Zi (where the probability of succes p is passed as an argument) simul returns T the vector of durations between two declared side effects

Usage

```
simul(nbPatient, disXi, disP, toplot = TRUE)
```

Arguments

nbPatient	the number of patient of the simulation
disXi	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
disP	the side effect probability (success probability of Zi) p : disP is a 3 elements list : disfun stands for a distribution function ; nbparam for number of parameter of this distribution and param for a list of parameters
toplot	a logical variable to plot the variable Zi

Value

T the vector of durations between two declared side effects

Note

further notes

Author(s)

Christophe Dutang and Julie Barthes

See Also

simul2

Examples

```
arg1Exp <- list(rangen=rexp,nbparam=1,param=list(1/3));
arg1Bin <- list(rangen=rbinom,nbparam=2,param=list(1,1/20));
arg1Unif <- list(rangen=runif,nbparam=2,param=list(0,20));
arg1Lnorm <- list(rangen=rlnorm,nbparam=2,param=list(1/4,1));

arg2Exp <- list(disfun=pexp,nbparam=1,param=list(1/5));
arg2Cst <- list(disfun=pcst <- function(x,p) p ,nbparam=1,param=list(1/3));
arg2Comp <- list(disfun=pcomp <- function(x,mu1,mu2,mu3)
{1-1/3*exp(-mu1* x)-1/2*exp(-mu2 *x)-1/6*exp(-mu3 *x)}
,nbparam=3,param=list(1/3,1/5,1/10));
arg2Gamma <- list(disfun=pgamma,nbparam=2,param=list(3,1/3));
arg2Lnorm <- list(disfun=plnorm,nbparam=2,param=list(1/20,2));

T <- simul(100,arg1Exp,arg2Exp)
T <- simul(100,arg1Bin,arg2Cst)
T <- simul(100,arg1Unif,arg2Comp)
T <- simul(100,arg1Lnorm,arg2Gamma)
```

---

simul2 *simulate the second model of the hospital risk*

Description

simul simulate the first model of the hospital that is to say simulating the sequence of variables Xi (which follow the disxi distribution passed as an argument) and the sequence of Zi (where the probability of succes p is passed as an argument) simul returns T the vector of durations between two declared side effects

Usage

```
simul2(nbPatient, disXi, disYi, toplot = TRUE)
```

Arguments

nbPatient	the number of patient of the simulation
disXi	the distribution of the variable Xi : disXi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
disYi	the distribution of the variable Yi : disYi is a 3 elements list : rangen stands for a random positive variable generator ; nbparam for number of parameter of this distribution and param for a list of parameters
toplot	a logical variable to plot the variable Zi

Value

T the vector of durations between two declared side effects

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
arg1Exp<-list(rangen=rexp,nbparam=1,param=list(1/2));
arg2Exp<-list(rangen=rexp,nbparam=1,param=list(1/20));
T<-simul2(100,arg1Exp,arg2Exp)
```

Table *make an array of bias, variance and R for different distribution and estimators*

Description

this function prints an array of the bias, variance, risk constants R and CR for three estimators (parametric, non parametric and De Vielder) with different side effect probability for p

Usage

```
Table(file, nb = 10, mod)
```

Arguments

file	the file in wich the simulation will be done
nb	the number of simulation for each estimators
mod	first mod makes simulation for an estimator in different cases (arg2) second mod makes simulation for a case with different estimators third mod makes simulation for a case with the parametric and non parametric estimatorse

Value

Null.

Author(s)

Christophe Dutang and Julie Barthes

Examples

```
#Table("d.rda",100,3)

# plot the following result
#[1] "arg2Exp"
#           nonpar           par
#bias 4.407856e-02 -3.503516e-06
#var  6.001352e-05  1.972828e-05
#R    9.405885e-02  4.997679e-02
#CR   8.492920e+00  1.455619e+01
#[1] "arg2Cst"
#           nonpar          par
#bias 1.575410e-02 4.573187e-04
#var  1.714712e-05 5.675577e-06
#R    3.242554e-02 1.712875e-02
#CR   2.197198e+01 4.066553e+01
#[1] "arg2Comp"
#           nonpar           par
#bias 3.247060e-02 -5.558817e-05
#var  4.621880e-05  1.006148e-05
#R    6.880894e-02  3.628275e-02
#CR   1.101930e+01  1.967524e+01
#[1] "arg2Gamma"
#           nonpar           par
#bias 1.832645e-02 -7.552530e-04
#var  2.267637e-05  7.363311e-06
#R    3.778277e-02  1.870107e-02
#CR   1.911443e+01  3.773611e+01
#[1] "arg2Lnorm"
#           nonpar          par
#bias 4.556463e-02 1.017082e-03
#var  7.013414e-05 3.104221e-05
#R    1.005464e-01 5.599889e-02
#CR   8.101552e+00 1.318976e+01
#[1] "arg2Unif"
#           nonpar          par
#bias 2.514426e-02 2.598740e-04
#var  3.878331e-05 1.073282e-05
#R    5.236710e-02 2.748271e-02
#CR   1.408411e+01 2.580822e+01
#[1] "arg2Weib"
#           nonpar          par
#bias 4.588473e-03 1.540856e-04
#var  5.405285e-06 1.589171e-06
#R    9.367470e-03 4.933083e-03
#CR   7.709814e+01 1.468196e+02
#
```

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