Package ‘CUSUMdesign’

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Type Package
Title Compute Decision Interval and Average Run Length for CUSUM Charts
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Description Computation of decision intervals (H) and average run lengths (ARL) for CUSUM charts.
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getARL

compute average run length (ARL) for CUSUM charts

Description

Compute average run lengths for CUSUM charts based on the Markov chain algorithm.

Usage

getARL(distr=NULL, K=NULL, H=NULL, Mean=NULL, std=NULL, prob=NULL, Var=NULL, mu=NULL, lambda=NULL, samp.size=NULL, is.upward=NULL, winsrl=NULL, winsru=NULL)
Arguments

distr  Integer valued from 1 to 6: 1 refers to “normal mean”, 2 refers to “normal variance”, 3 refers to “Poisson”, 4 refers to “binomial”, 5 refers to “negative binomial”, and 6 refers to “inverse Gaussian mean”.

K   A reference value, which is given by getH.

H   A given decision interval, which is given by getH.

Mean   Mean value, which has to be provided when distr = 1 (normal mean), 3 (Poisson), and 5 (negative binomial). The value must be positive when distr = 3 or distr = 5.

std   Standard deviation, which has to be provided when distr = 1 (normal mean) and 2 (normal variance). The value must be positive.

prob   Success probability, which has to be provided when distr = 4 (binomial); 0 < prob <= 1.

Var   Variance, which has to be provided when distr = 5 (negative binomial). The value has to be larger than Mean when distr = 5.

mu   A positive value representing the mean of inverse Gaussian distribution. The argument ‘mu’ has to be provided when distr = 6 (inverse Gaussian mean).

lambda   A positive value representing the shape parameter for inverse Gaussian distribution. The argument ‘lambda’ has to be provided when distr = 6 (inverse Gaussian mean).

samp.size   Sample size, an integer which has to be provided when distr = 2 (normal variance) or distr = 4 (binomial).

is.upward   Logical value, whether to depict a upward or downward CUSUM.

winsrl   Lower Winsorizing constant. Use NULL or -999 if Winsorization is not needed.

winsru   Upper Winsorizing constant. Use NULL or 999 if Winsorization is not needed.

Details

Computes ARL when the reference value and decision interval are given. For each case, the necessary parameters are listed as follows.

Normal mean (distr = 1): Mean, std, K, H.
Normal variance (distr = 2): samp.size, std, K, H.
Poisson (distr = 3): Mean, K, H.
Binomial (distr = 4): samp.size, prob, K, H.
Negative binomial (distr = 5): Mean, Var, K, H.
Inverse Gaussian mean (distr = 6): mu, lambda, K, H.

Value

A list including three variables:

ARL_Z   The computed zero-start average run length for CUSUM.
ARL_F   The computed fast-initial-response (FIR) average run length for CUSUM.
ARL_S   The computed steady-state average run length for CUSUM.
getH

Description

Compute decision intervals for CUSUM charts.

Usage

getH(distr=NULL, ARL=NULL, ICmean=NULL, ICsd=NULL, OOCmean=NULL, OOCsd=NULL, ICprob=NULL, OOCprob=NULL, IVar=NULL, IClambda=NULL, samp.size=NULL, ref=NULL, winsrl=NULL, winsru=NULL, type=c("fast initial response", "zero start", "steady state"))
Arguments

distr  Integer valued from 1 to 6: 1 refers to “normal mean”, 2 refers to “normal variance”, 3 refers to “Poisson”, 4 refers to “binomial”, 5 refers to “negative binomial”, 6 refers to “inverse Gaussian mean”.

ARL  An integer for in control average run length.

ICmean  In-control mean, which has to be provided when distr = 1 (normal mean), 3 (Poisson), 5 (negative binomial), and 6 (inverse Gaussian mean). The value has to be positive when distr = 3, distr = 5, or distr = 6.

ICsd  In-control standard deviation, which has to be provided when distr = 1 (normal mean) and 2 (normal variance). The value has to be positive.

OOCmean  Out-of-control mean, which has to be provided when distr = 1 (normal mean), 3 (Poisson), 5 (negative binomial), and 6 (Inverse Gaussian mean). When distr = 3, 5, or 6, the value has to be positive.

OOCsd  Out-of-control standard deviation, which has to be provided when distr = 2 (normal variance). The value has to be positive.

ICprob  In-control success probability, which has to be provided when distr = 4 (binomial); 0 < prob <= 1.

OOCprob  Out-of-control success probability, which has to be provided when distr = 4 (binomial); 0 < prob <= 1.

ICvar  In-control variance, which has to be provided when distr = 5 (negative binomial). The value has to be larger than the in-control mean ‘ICmean’.

IClambda  In-control shape parameter for inverse Gaussian distribution. The argument ‘IClambda’ has to be provided when distr = 6 (inverse Gaussian mean).

sampNsize  Sample size, an integer which has to be provided when distr = 2 (normal variance) or distr = 4 (binomial).

ref  Optional reference value.

winsrl  Lower Winsorizing constant. Use NULL or -999 if Winsorization is not needed.

winsru  Upper Winsorizing constant. Use NULL or 999 if Winsorization is not needed.

type  A string for CUSUM type: “F” for fast-initial-response CUSUM, “Z” for zero-start CUSUM, and “S” for steady-state CUSUM. Default is “F”.

Details

Computes the decision interval H when the reference value and the average run length are given. For each case, the necessary parameters are listed as follows.

Normal mean (distr = 1): ICmean, ICsd, OOCmean.
Normal variance (distr = 2): sampNsize, ICsd, OOCsd
Poisson (distr = 3): ICmean, OOCmean.
Binomial (distr = 4): sampNsize, ICprob, OOCprob.
Negative binomial (distr = 5): ICmean, ICvar, OOCmean.
Inverse Gaussian mean (distr = 6): ICmean, IClambda, OOCmean.
Value

A list including three variables:

- **DI**: Decision interval.
- **IC_ARL**: In-control average run length.
- **00CARL_Z**: Out-of-control average run length for the zero-start CUSUM.
- **00CARL_F**: Out-of-control average run length for the fast-initial-response (FIR) CUSUM.
- **00CARL_S**: Out-of-control average run length for the steady-state CUSUM.

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References


See Also

getARL

Examples

```r
# normal mean
geth(distr=1, ICmean=10, ICsd=2, OOCmean=15, ARL=1000, type="F")

# normal variance
geth(distr=2, ICsd=2, OOCsd=4, samp.size=5, ARL=1000, type="F")

# Poisson
geth(distr=3, ICmean=2, OOCmean=3, ARL=100, type="F")

# Binomial
geth(distr=4, ICprob=0.2, OOCprob=0.6, samp.size=100, ARL=1000, type="F")

# Negative binomial
geth(distr=5, ICmean=1, ICvar=3, OOCmean=2, ARL=100, type="F")

# Inverse Gaussian mean
geth(distr=6, ICmean=1, IClambda=0.5, OOCmean=2, ARL=1000, type="F")
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