Package 'CMPControl'

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Type Package

Title Control Charts for Conway-Maxwell-Poisson Distribution

Version 1.0

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Description The main purpose of this package is to juxtapose the different control limits obtained by modelling a data set through the COM-Poisson distribution vs. the classical Poisson distribution. Accordingly, this package offers the ability to compute the COM-Poisson parameter estimates and plot associated Shewhart control charts for a given data set.

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`CMPControl-package` *Control Charts for Conway-Maxwell-Poisson Distribution*

Description

The main purpose of this package is to juxtapose the different control limits obtained by modelling a data set through the COM-Poisson distribution vs. the classical Poisson distribution. Accordingly, this package offers the ability to compute the COM-Poisson parameter estimates and plot associated Shewhart and true probability bounds for a given data set.

Details

Package:	CMPControl
Type:	Package
Version:	1.0
Date:	2014-04-05
License:	What license is it under?

For a given data set, the user can use the ControlCharts function to overlay any combination of the 3-sigma Shewhart CMP control chart, 3-sigma Shewhart classical Poisson control chart (c-chart), and the true CMP probability limits. The function also returns a list with relevant values relating to the control charts.

Author(s)

Kimberly Sellers, Luis Costa

Maintainer: Luis Costa <lc436@georgetown.edu>

References

Sellers, Kimberly F. "A Generalized Statistical Control Chart for Over- or Under-Dispersed Data." Quality and Reliability Engineering International 2012. ; 28:59-65.

Saghir, A., Lin, Z., Abbasi, S. A., Ahmad, S. "The Use of Probability Limits of COM-Poisson Charts and their Applications." Quality and Reliability Engineering International 2013 ; 29:759-770.

Montgomery, Douglas C. "Introduction to Statistical Quality Control" (4th Ed). Wiley: New York, 2001.

Examples

```
ControlCharts(nonconformities,"Sample Number", "Number of nonconformities")
```

`ComputeLambdaAndNuHat.shiftCMPest` *Compute Lambda and Nu Hat for a given data set*

Description

Computes the COM-Poisson lambda and nu parameter estimates for a given data set.

Usage

```
ComputeLambdaAndNuHat.shiftCMPest(y,lambdainit=mean(y)-min(y),nuinit=1,a=min(y),max=100)
```

Arguments

`y`	The data set in question, as a vector
`lambdainit`	Initial value for Lambda
`nuinit`	Initial value for Nu
`a`	The location shift constant
`max`	Maximum number of iterations to run for truncating infinite sums

Details

Uses the built-in nlminb function (constrained optimization) to maximize the COM-Poisson log-likelihood function for a given data set and therefore compute the maximum likelihood estimators Lambda and Nu for said data set.

Value

Returns the maximum likelihood estimates for lambda and nu using constrained optimization through nlminb.

Author(s)

Kimberly Sellers

References

Sellers, Kimberly F. "A Generalized Statistical Control Chart for Over- or Under-Dispersed Data." Quality and Reliability Engineering International 2012. ; 28:59-65.

`computez.lambdaest` *Compute the normalizing constant Z*

Description

Computes the normalizing constant Z in the COM-Poisson model for the given parameters of lambda and nu.

Usage

```
computez.lambdaest(lambda, nu, max)
```

Arguments

`lambda`	Lambda value in the COM-Poisson distribution
`nu`	Nu value in the COM-Poisson distribution
`max`	Maximum number of iterations to run for truncating infinite sums

Details

Computez.lambdaest estimates the COM-Poisson normalizing constant.

Value

After the specified number of iterations, the function returns the normalizing constant Z as a real number.

Author(s)

Kimberly Sellers

References

Sellers, Kimberly F. "A Generalized Statistical Control Chart for Over- or Under-Dispersed Data." Quality and Reliability Engineering International 2012. ; 28:59-65.

`ControlCharts` *Parameter estimation and control chart construction*

Description

Computes the COM-Poisson parameters (lambda and nu) for a given data set and plots any combination of the 3-sigma COM-Poisson Shewhart control chart, the 3-sigma classical Poisson Shewhart control chart, and the data set's true COM-Poisson probability limits.

Usage

```
ControlCharts(data, xlabel, ylabel, CMP=TRUE, P=TRUE, CMPProb=TRUE)
```

Arguments

`data`	The data set in question, as a vector
`xlabel`	The desired x-axis label, inputted in quotation marks
`ylabel`	The desired y-axis label, inputted in quotation marks
`CMP`	Input CMP=TRUE to plot the 3-sigma COM-Poisson Shewhart control chart and CMP=FALSE to not plot it. Defaults to TRUE.
`P`	Input P=TRUE to plot the 3-sigma classical Poisson Shewhart control chart and P=FALSE to not plot it. Defaults to TRUE.
`CMPProb`	Input P=TRUE to plot the true CMP probability limits and P=FALSE to not plot them. Defaults to TRUE.

Details

This function depends on the compoisson package.

Value

ControlCharts plots any combination of the 3-sigma COM-Poisson Shewhart control chart, the 3-sigma classical Poisson Shewhart control chart, and the data set's true COM-Poisson probability limits. By default, the code overlays the three control charts. However, users may omit one or more control charts by switching the Boolean value of the control charts they wish to omit to FALSE when running the code.

The code also returns a list containing the following values:

`CMP Lambda Hat and Nu Hat`
: CMP parameters Lambda and Nu for the given data

`CMP Mean and Standard Deviation`
: The CMP mean and standard deviation of the data

`CMP Shewhart Upper and Lower Bounds`
: 3-Sigma upper and lower CMP bounds

`Poisson Mean and Standard Deviation`
: The classical Poisson mean and standard deviation of the data

`Poisson Shewhart Upper and Lower Bounds`
: 3-Sigma upper and lower classical Poisson bounds

`Upper Out of Control Observations`
: Observations that lay above the upper control limits

`Lower Out of Control Observations`
: Observations that lay below the lower control limits

`CMP Probability Limits`
: Values of the true CMP probability limits

Author(s)

Kimberly Sellers, Luis Costa

References

Sellers, Kimberly F. "A Generalized Statistical Control Chart for Over- or Under-Dispersed Data." Quality and Reliability Engineering International 2012. ; 28:59-65.

Saghir, A., Lin, Z., Abbasi, S. A., Ahmad, S. "The Use of Probability Limits of COM-Poisson Charts and their Applications." Quality and Reliability Engineering International 2013 ; 29:759-770.

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nonconformities *Nonconformities in printed circuit boards*

Description

The number of nonconformities observed in 26 successive samples of 100 printed circuit boards. A nonconforming item is a unit of product that does not satisfy one or more of the specifications for that product.

Usage

```
nonconformities
```

Format

The format is: num [1:26] 21 24 16 12 15 5 28 20 31 25 ...

Source

Montgomery, Douglas C. "Introduction to Statistical Quality Control" (4th Ed). Wiley: New York, 2001.Pages 330/331.

Examples

```
ControlCharts(nonconformities,"Sample Number","Number of nonconformities")
```

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