Package ‘bcc’

April 28, 2020

Title Beta Control Charts

Version 1.3.1

Description Applies beta control charts to defined values, using 'qcc' package with new beta control limits. The Beta Chart presents the control limits based on the Beta probability distribution. Can be used for monitoring fraction data from Binomial distribution as replacement of the p-Charts. The Beta Chart was applied for monitoring the variables in three real studies, and it was compared to the control limits with three schemes. The comparative analysis showed that: (i) Beta approximation to the Binomial distribution was more appropriate with values confined in the [0, 1]- interval; and (ii) the charts proposed were more sensitive to the average run length (ARL), in both in-control and out-of-control processes monitoring. The Beta Charts outperform the Shewhart control charts analyzed for monitoring fraction data. Ângelo Márcio Oliveira Sant’Anna, Carla Schwengber ten Caten (2012) <doi:10.1016/j.eswa.2012.02.146>.

Depends R (>= 2.10)

URL https://danielucas28.github.io/

License GPL

Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Imports qcc, methods

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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Description

Create an object of class 'qcc' to perform statistical quality control. This object may then be used to plot Beta Control Charts.

Usage

bcc(data, type = c("1", "2"), sizes, center, std.dev, limits, data.name, labels, newdata, newsizes, newdata.name, newlabels, nsigmas = 3, confidence.level = 0.9, rules = shewhart.rules, plot = TRUE, ...)

Arguments

data a data frame, a matrix or a vector containing observed data for the variable to chart. Each row of a data frame or a matrix, and each value of a vector, refers to a sample or "rationale group".
type a character string specifying the group statistics to compute. There are two possible types: 1 for discrete data and 2 for continuous data.
sizes a value or a vector of values specifying the sample sizes associated with each group. If data is continuous this parameter should be ignored
center a value specifying the center of group statistics or the "target" value of the process.
std.dev a value or an available method specifying the within-group standard deviation(s) of the process.
limits a two-values vector specifying control limits.
data.name a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as data.
labels a character vector of labels for each group.
newdata  a data frame, matrix or vector, as for the data argument, providing further data to plot but not included in the computations.

newsizes a vector as for the sizes argument providing further data sizes to plot but not included in the computations.

newdata.name a string specifying the name of the variable which appears on the plots. If not provided is taken from the object given as newdata.

newlabels a character vector of labels for each new group defined in the argument newdata.

nsigmas  a numeric value specifying the number of sigmas to use for computing control limits. It is ignored when the confidence.level argument is provided.

confidence.level  a numeric value between 0 and 1 specifying the confidence level of the computed probability limits.

rules  a value or a vector of values specifying the rules to apply to the chart. See shewhart.rules for possible values and their meaning.

plot logical. If TRUE a Shewhart chart is plotted.

... further arguments are ignored.

Details
The Beta Chart presents the control limits based on the Beta probability distribution. It was can be used for monitoring fraction data from Binomial distribution as replacement of the p-Charts. The Beta Chart was applied for monitoring the variables in three real studies, and it was compared to the control limits with three schemes. The comparative analysis showed that: (i) Beta approximation to the Binomial distribution was more appropriate with values confined in the [0, 1]-interval; and (ii) the charts proposed were more sensitive to the average run length (ARL), in both in-control and out-of-control processes monitoring. The Beta Charts outperform the Shewhart control charts analyzed for monitoring fraction data. This package was made based on the qcc package. See qcc.

Value
Returns an object of class 'qcc'.

References


Examples

data("Drapper1998data")
bcc(data = Drapper1998data, type = "2")
data("Montgomery2005")
bcc(data=Montgomery2005$Defective, sizes = Montgomery2005$Sample, type=1)
Draper1998data  Drapper 1998 data

Description
Draper1998data consists of a data set of the study of contaminated peanut by toxic substances in 34 batches of 120 pounds.

Usage
data(Draper1998data)

Format
A data frame with 34 observations on the following 1 variable.

   PROP  a numeric vector

References

Examples
data(Draper1998data)
attach(Draper1998data)
boxplot(Draper1998data)
plot(Draper1998data)

limits.beta  Limits for discrete data

Description
These function are used to compute the upper and lower control limits.

Usage
limits.beta(center, std.dev, sizes, conf)

Arguments

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>center</td>
<td>sample/group center statistic.</td>
</tr>
<tr>
<td>std.dev</td>
<td>within group standard deviation.</td>
</tr>
<tr>
<td>sizes</td>
<td>sample sizes.</td>
</tr>
<tr>
<td>conf</td>
<td>a numeric value used to compute control limits, specifying the confidence level (0 &lt; conf &lt; 1)</td>
</tr>
</tbody>
</table>
Value

The function `limits.beta` returns a matrix with lower and upper control limits.

Examples

```
data(Montgomery2005)
limits.beta(center = 0.2313333, std.dev = 0.421685, sizes = Montgomery2005$Sample, conf = 0.9)
```

---

`limits.beta.p`  
*Limits for continuos data*

Description

These function are used to compute the upper and lower control limits.

Usage

```
limits.beta.p(center, std.dev, sizes, conf, ...)
```

Arguments

- `center` sample/group center statistic.
- `std.dev` within group standard deviation.
- `sizes` sample sizes.
- `conf` a numeric value used to compute control limits, specifying the confidence level (if $0 < \text{conf} < 1$)
- `...` further arguments are ignored.

Value

The function `limits.beta.p` returns a matrix with lower and upper control limits.

Examples

```
limits.beta.p(center = 0.9989597, std.dev = 0.0009362578, conf = 0.9)
```
Montgomery2005 Montgomery 2005 data

Description
Montgomery2005 consists of a data set of a manufacturing process of frozen orange juice concentrate in 30 packages of 50 units each.

Usage
data(Montgomery2005)

Format
A data frame with 30 observations on the following 2 variables.

Sample a numeric vector
Defective a numeric vector

References

Examples
data(Montgomery2005)
attach(Montgomery2005)
boxplot(Montgomery2005)
plot(Montgomery2005)

sd.beta

Description
These functions are used to compute statistics required by the beta chart.

Usage
sd.beta(data, sizes, ...)

Arguments
data the observed data values.
sizes sample sizes
... further arguments are ignored.
Details

Performs the calculation of the standard deviation \( \text{std.dev} \) that will be used in the construction of the control chart.

Value

The function \( \text{sd.beta} \) returns \( \text{std.dev} \) the standard deviation of the statistic charted.

Examples

```r
data(Montgomery2005)
sd.beta(Montgomery2005$Defective, Montgomery2005$Sample)
```

---

Description

These functions are used to compute statistics required by the beta chart.

Usage

```r
\text{sd.beta.p}(\text{data}, \text{sizes}, \text{std.dev})
```

Arguments

- `data` the observed data values.
- `sizes` sample sizes
- `std.dev` within group standard deviation.

Details

Performs the calculation of the standard deviation \( \text{sd} \) that will be used in the construction of the control chart.

Value

The function \( \text{sd.beta.p} \) returns \( \text{sd} \) the standard deviation of the statistic charted.

Examples

```r
data(Draper1998data)
sd.beta.p(Draper1998data)
```
Description

These functions are used to compute statistics required by the beta chart.

Usage

stats.beta(data, sizes)

Arguments

data: the observed data values.
sizes: sample sizes

Details

Provides a list containing the centerline of the chart pbar and the data manipulated to be used in the construction of the chart data/sizes.

Value

The function stats.beta returns a list with components statistics and center.

Examples

data(Montgomery2005)
stats.beta(Montgomery2005$Defective, Montgomery2005$Sample)

Description

These functions are used to compute statistics required by the beta chart.

Usage

stats.beta.p(data,sizes)

Arguments

data: the observed data values.
sizes: sample sizes
**Details**

Provides a list containing the center line of the graph center and the data to be used in the construction of the chart statistics.

**Value**

The function `stats.beta.p` returns a list with components `statistics` and `center`.

**Examples**

```r
data(Drapper1998data)
sd.beta.p(Drapper1998data)
```
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