Package 'CC'

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Title Control Charts

Version 1.0

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Description Tools for creating and visualizing statistical process control charts. Control charts are used for monitoring measurement processes, such as those occurring in manufacturing. The objective is to monitor the history of such processes and flag outlying measurements: out-of-control signals. Montgomery, D. (2009, ISBN:978-0-470-16992-6) contains an extensive discussion of the methodology.

LazyLoad true

LazyData true

ZipData no

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License GPL (>= 2)

NeedsCompilation no

Repository CRAN

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Contents

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diffrange   *difference of range*

Description

This function computes the length of the range of a sample.

Usage

```
diffrange(x)
```

Arguments

x   a numeric vector

Value

a numeric object

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

RCC, xbarRCC

Examples

```
x <- rnorm(10)
diffrange(x)
```

---

d_2 *range factors*

Description

The sample range R is a biased estimator for the population standard deviation. For a normally distributed sample of size n, R/d2(n) is unbiased.

Usage

```
d_2(n)
```

Arguments

n   the sample size

Value

a numeric value representing the multiplier to render R unbiased

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

[d_3](d_3)

Examples

```
x <- rnorm(10, sd = 3)
R <- diff(range(x))
R/d_2(10)   # expected value of this is 3
```

---

d_3 *range factors*

Description

The sample range R is a biased estimator for the population standard deviation of R. For a normally distributed sample of size n, d_3(n)R is an unbiased estimator of the standard deviation of R.

Usage

```
d_3(n)
```

Arguments

n   the sample size

Value

a numeric value representing the multiplier to render R unbiased for the standard deviation of R

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

[d_2](d_2)

Examples

```
x <- rnorm(10, sd = 3)
R <- diff(range(x))
d_3(10)*R   # expected value of this is (V(R))^{1/2}
```

LRCC *Lowess-Range-Chart*

Description

Trial limits for the Lowess-Range Chart, and an estimator of the process standard deviation. This chart is appropriate for subgroups of size 1.

Usage

```
LRCC(x, sigma, plotit = FALSE)
```

Arguments

x	a numeric vector containing the process measurements
sigma	(optional) the standard deviation of the measurements
plotit	logical value indicating whether a plot should be produced

Value

an estimate of the standard deviation and a plot of the chart

Author(s)

W.J. Braun

References

Braun, W.J. (2002) The LR-chart: An Alternative to the MR-chart.

See Also

xbarRCC

Examples

```
LRCC(rnorm(10))
```

---

plot.CC   *Plot Shewhart Control Charts*

Description

This function plots control charts of various types.

Usage

```
## S3 method for class 'CC'
plot(x, start = 1, ...)
```

Arguments

x	Object of class "CC"
start	Index of first plotted point
...	Arguments to be passed to methods, such as graphical parameters (see 'par'). This method also accepts the argument 'start' which specifies the index of first plotted point, which is 1L by default.

Value

a plot of control charts for variability and location

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

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RCC   *R Chart Parameters*

Description

This function computes control limits for R-charts, optionally revising them in the case that ranges plot out of the trial control limits.

Usage

```
RCC(R, n, k=3, sigma)
```

Arguments

R	a numeric vector consisting of the subgroup ranges
n	the subgroup size
k	the control chart parameter governing the width of the control limits
sigma	(optional) an estimate of the in-control standard deviation

Value

a list consisting of the upper and lower control limits and the centerline

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

`plot.CC`

Examples

```
x <- matrix(rnorm(120, sd = 3), ncol=12)
x.R <- xbarRCC(x)
plot(x.R)
x.R <- xbarRCC(x, newdata=rnorm(12))
plot(x.R)
```

---

rr	*Baseline Heart Rate Summaries*

Description

Daily averages and variances for 2 minute records of R wave-to-R wave (RR) intervals for a single male individual. Measurements were recorded during the summer of 2018.

Usage

```
data(rr)
```

Format

A data frame with 76 observations on the following 2 variables.

Avg Daily averages

Var Daily variances

Examples

```
sapply(rr, mean)
```

---

rrCC   *Individuals Charts Parameters for Baseline RR Mean and Variability*

Description

This function computes control limits for the x-charts for the mean and standard deviation (reciprocal) of R wave to R wave values for heart rate, optionally revising them in the case that individual sample means and/or ranges plot out of the trial control limits.

Usage

```
rrCC(RR, k=3, revise=TRUE, newdata)
```

Arguments

RR
: a data frame with 2 columns, the first containing rr averages and the second containing rr variances

k
: the control chart parameter governing the width of the control limits

revise
: if TRUE, mu and sigma are estimated using only range values that plot inside the trial control limits

newdata
: a 2 column matrix consisting of data from new subgroups, with averages in the first column and variances in the second column

Value

an object of class "CC"

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

```
plot.CC
```

Examples

```
rr.xLR <- rrCC(rr)
plot(rr.xLR)
```

---

xbarCC   *xbar Chart Parameters*

Description

This function computes control limits for the xbar charts, optionally revising them in the case that individual sample means plot outside the trial control limits.

Usage

```
xbarCC(xbar, n, sigma, k, mu)
```

Arguments

xbar   a numeric vector consisting of the subgroup averages

n   the subgroup size

k   the control chart parameter governing the width of the control limits

sigma   an estimate of the in-control standard deviation

mu   (optional) an estimate of the in-control mean

Value

a list consisting of the upper and lower control limits and the centerline.

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

```
plot.CC
```

Examples

```
x <- matrix(rnorm(120, sd = 3), ncol=12)
x.R <- xbarRCC(x)
plot(x.R)
x.R <- xbarRCC(x, newdata=rnorm(12))
plot(x.R)
```

| xbarRCC | *Computing xbar and R-chart Parameters* |

Description

This function computes control limits for the xbar and R-charts, optionally revising them in the case that individual sample means and/or ranges plot out of the trial control limits.

Usage

```
xbarRCC(qc.obj, k=3, sigma, mu, revise=TRUE, newdata)
```

Arguments

qc.obj	an object of class CC
k	the control chart parameter governing the width of the control limits
sigma	(optional) an estimate of the in-control standard deviation
mu	(optional) an estimate of the in-control mean
revise	if TRUE, mu and sigma are estimated using only range values that plot inside the trial control limits
newdata	an n-vector or matrix having n columns, consisting of data from new subgroups

Value

an object of class "CC"

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

```
plot.CC
```

Examples

```
x <- matrix(rnorm(120, sd = 3), ncol=12)
x.R <- xbarRCC(x)
plot(x.R)
```

---

xCC	*x-Chart Parameters*

Description

This function computes control limits for the x-charts, optionally revising them in the case that individual values plot outside the trial control limits.

Usage

```
xCC(x, sigma, k = 3, mu, newdata)
```

Arguments

x	a numeric vector consisting of the subgroup averages
k	the control chart parameter governing the width of the control limits
sigma	an estimate of the in-control standard deviation
mu	(optional) an estimate of the in-control mean
newdata	(optional) new observations

Value

a list consisting of the upper and lower control limits and the centerline.

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

plot.CC

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xLRCC *Computing x and LR-chart Parameters*

Description

This function computes control limits for the x and LR-charts, optionally revising them in the case that individual sample means and/or ranges plot out of the trial control limits.

Usage

```
xLRCC(qc.obj, k=3, sigma, mu, revise=TRUE, newdata)
```

Arguments

qc.obj	an object of class CC
k	the control chart parameter governing the width of the control limits
sigma	(optional) an estimate of the in-control standard deviation
mu	(optional) an estimate of the in-control mean
revise	if TRUE, mu and sigma are estimated using only range values that plot inside the trial control limits
newdata	an n-vector consisting of data from new subgroups

Value

an object of class "CC"

Author(s)

W.J. Braun

References

Montgomery, D.C. (2000) Introduction to Statistical Quality Control, Wiley

See Also

plot.CC

Examples

```
rr.xLR <- xLRCC(rr$Avg)
plot(rr.xLR)
```

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