Package 'XRSCC'

December 7, 2024

Type Package

Title Statistical Quality Control Simulation

Version 0.2

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Description This is a set of statistical quality control functions, that allows plotting control charts and its iterations, process capability for variable and attribute control, highlighting the xrs_gr() function, like a first iteration for variable chart, meanwhile the we_rules() function detects non random patterns in sample.

Depends R (>= 3.5.0)

License GPL (>= 2)

LazyData TRUE

Imports stats, graphics, utils, grDevices

NeedsCompilation no

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Contents

`XRSCC-package` *Calculates and plots variable and attributes control charts*

Description

Calculates the control limits for each type of variable or attribute control chart, then using an iteration to get the true control limits

Details

Package:	XRSCC
Type:	Package
Version:	0.1
Date:	2016-05-04
License:	GPL

Author(s)

Erick Marroquin
Maintainer: Erick Marroquin <ericksuhel@gmail.com>

`Beta.X` *X chart OC Curve*

Description

Calculates and plots the risk of not detecting shifts and the Average Run Length

Usage

```
Beta.X(k,n)
```

Arguments

`k`	A numeric vector, of length one, is the *k* standard deviations factor since the known mean
`n`	An integer, equal the sample size

Value

`beta`	risk of not detecting shifts
`ARL`	Average Run Lengh

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`xrs_gr`

Examples

```
Beta.X(k=1,n=5)
Beta.X(k=0.5,n=5)
Beta.X(k=1,n=3)
```

bottles *Defetive bottles sample*

Description

The data give the number of defective bottles in a fixed sample size

Usage

```
data(bottles)
```

Format

A data frame with 80 observations on the following variable.

`D` a numeric vector of integer number of defective bottles

Examples

```
data(bottles)
require(XRSCC)
p_gr(bottles, n=100)
```

clothes *Defective number per sample*

Description

The data give a defectives number in a clothes process

Usage

```
data(clothes)
```

Format

A data frame with 90 observations on the following variable.

`c` a numeric vector of integer number of nonconformities in a sample

Examples

```
require(XRSCC)
data(clothes)
c_gr(clothes)
```

clothes2 *Defective number per unit*

Description

The data give a nonconformities number in a clothes process in a variable sample

Usage

```
data(clothes2)
```

Format

A data frame with 90 observations and two variables.

`d` a numeric vector of integer number of nonconformities in a sample

`n` a numeric vector of sample size

Examples

```
require(XRSCC)
data(clothes2)
u_gr(clothes2)
```

Cp_X *Calculates the process capability*

Description

Given a variable sample, the function calculates the process capability and, assuming a normal distribution of the X chart, after the true control limits were found.

Usage

```
Cp_X(prev.results, LES, LEI, mu)
```

Arguments

`prev.results`	Is a list of previous results obtained by the `xrs_gr` function in the first iteration, or the results obtained in further iterations by the `X_it` function.
`LES`	A numeric vector of length one, containing the upper specification limit.
`LEI`	A numeric vector of length one, containing the lower specification limit.
`mu`	A numeric vector of length one, containing the average specification, if not exists, function takes the Control Limit of previous results.

Details

The function stops for the lack of any arguments.

Value

`Cp`	The process capability index
`Cpk`	The process capability index in case is not centered
`P.cp`	The specification range percentage used by the control limits
`X.sigma`	The process standard deviation
`Conclusion del proceso`	A phrase to take conclusion about the process capability

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`xrs_gr` `X_it` `R_it` `we_rules`

Examples

```
data(vol_sample)
results1<-xrs_gr(vol_sample)
results2<-X_it(results1)
# Type dev.off() function before use Cp_X
Cp_X(results2, LES=510, LEI=490, mu=500)
```

---

c_gr *The c chart control for attributes*

Description

Calculates the *c* control chart for attributes, using a sample *C* of number of nonconformities. The plotted values in graph are the nonconformities number on each sample at a regular time interval when there is not a standard given.

Usage

```
c_gr(C)
```

Arguments

C	A data frame or a vector containing the number of nonconformities per sample. Note that the variable name must be the uppercase letter, like ***D***.

Value

in.control	The *under control* row list for the *c* chart
out.control	The *out of control* row list for the *c* chart
Iteraciones	The number of iterations, in this function always will be the first and the last one
data.0	The original data frame
data.1	Subsetting the data frame with *under control* rows
bin	The binary values for *out of control* equal to one, and results *under control* equal to zero
Limites de Control Grafica \emph{c}	The *c* chart control limits vector
Conclusion del proceso	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

p_gr, np_gr, u_gr, P_it, NP_it, C_it, U_it

Examples

```
data(clothes)
c_gr(clothes)
```

C_it *Iteration of c control chart for attributes*

Description

Calculates the iteration i'th, for the control limits of *c* chart using the results obtained in c_gr and previous C_it iteration.

Usage

```
C_it(prev.results)
```

Arguments

prev.results	Its a list of previous results obtained by the c_gr function. In other cases, needs more than one iteration, to obtain the true control limits, before take conclusions about the process.

Value

in.control	The *under control* row list for the *c* chart
out.control	The *out of control* row list for the *c* chart
Iteraciones	The number of iterations, It is assumed to be the second or later
data.0	The original data frame or vector
data.1	The *under control* subset after iteration
bin	The binary values for *out of control* equal to one and *under control* equal to zero
Limites de Control Grafica \emph{c}	The *c* chart control limits vector
Conclusion del proceso	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

p_gr, np_gr, u_gr, c_gr, P_it, NP_it, U_it

Examples

```
data(clothes)
r1<-c_gr(clothes)
r2<-C_it(r1)
r3<-C_it(r2)
```

dato2 *The piston hole length in mm*

Description

A sample containing piston hole length in mm

Usage

```
data(dato2)
```

Format

A data frame with 45 subgroup of 5 observations

`n1` a numeric vector of length in mm

`n2` a numeric vector of length in mm

`n3` a numeric vector of length in mm

`n4` a numeric vector of length in mm

`n5` a numeric vector of length in mm

Examples

```
data(dato2)
require(XRSCC)
results1<-xrs_gr(dato2)
results2<-X_it(results1)
results3<-R_it(results2)
```

factor.a *Table: Factor for variable control charts*

Description

A data frame containing the factor for variable control charts calculations.

Usage

```
data(factor.a)
```

Format

A data frame with factors (ex: A2, d2, D4 and so on) for size groups from 2 to 25.

Source

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

Examples

```
data(factor.a)
```

`np_gr` *The np chart control for attributes*

Description

Calculates the *np* control chart for attributes, using a sample *D* of number of defectives or nonconforming items and a constant sample size *n*. The values plotted in graph are the defectives number.

Usage

```
np_gr(D, n)
```

Arguments

`D`	A data frame containing the non conforming items, and must be integer and non negative.
`n`	A vector of length one, integer and nonnegative, to fix the sample size.

Value

`in.control`	The *under control* row list for the *np* chart
`out.control`	The *out of control* row list for the *np* chart
`Iteraciones`	The number of iterations, in this function always will be the first and the last one
`data.n`	The fixed sample size
`data.0`	The original data frame
`data.1`	The filtered data frame
`bin`	The binary values for *out of control* equal to one and *under control* equal to zero
`Limites de Control Grafica \emph{np}`	The *np* chart control limits vector
`Conclusion del proceso`	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

p_gr, u_gr, c_gr, P_it, NP_it, C_it, U_it

Examples

```
data(bottles)
np_gr(bottles, n=100)
```

NP_it *Iteration of np control chart for attributes*

Description

Calculates the iteration i'th for the control limits of *p* chart using the results obtained in np_gr or further NP_it iterations.

Usage

```
NP_it(prev.results)
```

Arguments

prev.results	Is a list of previous results obtained by the np_gr function. In other cases, needs more than one iteration, to obtain the true control limits for *np* chart before take conclusions about the process.

Value

in.control	The *under control* row list for the *np* chart in this iteration
out.control	The *out of control* row list for the *np* chart
Iteraciones	The number of iterations, It is assumed to be the second or later
data.n	The fixed sample size
data.0	The original data frame
data.1	The *under control* subset after iteration
bin	The binary values for *out of control* equal to one and *under control* equal to zero
Limites de Control Grafica \emph{np}	The *np* chart control limits vector
Conclusion del proceso	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

p_gr, np_gr, c_gr, u_gr, P_it, C_it, U_it

Examples

```
data(bottles)
r1<-np_gr(bottles, n=100)
r2<-NP_it(r1)
r3<-NP_it(r2)
```

---

p_gr *P control chart for attributes*

Description

Calculates the *p* control chart for attributes, using a sample *D* of number of defectives or non-conforming items and a constant sample size *n*. The values plotted in graph are the fractions *p*of defectives.

Usage

```
p_gr(D, n)
```

Arguments

D	A data frame containing in one column the non conforming items, and must be integer and non negative.
n	A vector of length one, integer and nonnegative, to fix the sample size.

Value

in.control	The *under control* row list for the *p* chart
out.control	The *out of control* row list for the *p* chart
Iteraciones	The number of iterations, in this function always will be the first and the last one
data.n	The fixed sample size
data.0	The original data frame
data.1	The filtered data frame

`bin` The binary values for *out of control* equal to one and *under control* equal to zero

`Limites de Control Grafica p`
The *p* chart control limits vector

`Conclusion del proceso`
The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`P_it`, `c_gr`, `C_it`, `np_gr`, `NP_it`, `u_gr`, `U_it`

Examples

```
data(bottles)
p_gr(bottles, n=100)
```

P_it *Iteration of p control chart for attributes*

Description

Calculates the iteration i'th for the control limits of *p* chart using the results obtained in `p_gr` or further P_it iterations.

Usage

```
P_it(prev.results)
```

Arguments

`prev.results` Is a list of previous results obtained by the `p_gr` function. In other cases, needs more than one iteration, to obtain the true control limits for *p* chart before take conclusions about the process.

Value

`in.control`	The *under control* row list for the *p* chart in this iteration
`out.control`	The *out of control* row list for the *p* chart
`Iteraciones`	The number of iterations, It is assumed to be the second or later
`data.n`	The fixed sample size
`data.0`	The original data frame
`data.1`	The *under control* subset after iteration
`bin`	The binary values for *out of control* equal to one and *under control* equal to zero
`Limites de Control Grafica \emph{p}`	The *p* chart control limits vector
`Conclusion del proceso`	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`p_gr`, `c_gr`, `C_it`, `np_gr`, `NP_it`, `u_gr`, `U_it`

Examples

```
data(bottles)
r1<-p_gr(bottles, n=100)
r2<-P_it(r1)
r3<-P_it(r2)
```

---

qqsugar *Sugar bags weights in pounds*

Description

A sample containing weights of sugar bags

Usage

```
data(qqsugar)
```

Format

A data frame with 100 subgroup of ten observations

`muestra1` a numeric vector of weights in pounds

`muestra2` a numeric vector of weights in pounds

`muestra3` a numeric vector of weights in pounds

`muestra4` a numeric vector of weights in pounds

`muestra5` a numeric vector of weights in pounds

`muestra6` a numeric vector of weights in pounds

`muestra7` a numeric vector of weights in pounds

`muestra8` a numeric vector of weights in pounds

`muestra9` a numeric vector of weights in pounds

`muestra10` a numeric vector of weights in pounds

Examples

```
data(qqsugar)
require(XRSCC)
xrs_gr(qqsugar)
```

R_it *Calculates the i'th iteration R Chart*

Description

Calculates the iteration i'th for R chart, after the X chart is under control. The function estimates if any value (range) is out of control limits, and returns a values list.

Usage

```
R_it(prev.results)
```

Arguments

`prev.results`	Is a list of previous results obtained by the `xrs_gr`, followed by `X_it` function if it is necessary. In other cases, needs more than one iteration to obtain the true control limits for R chart, before take conclusions about the process.

Details

The function stops if the R chart is under control already, and also stops if there is not any active graphic device.

Value

`in.control`	The under control row list for the X chart
`R.in.control`	The *under control* row list for the R chart
`out.control`	The *out of control* row list for the X chart
`Iteraciones`	The number of iterations, It is assumed to be the second or later
`data.0`	The original data frame
`data.1`	The filtered data frame
`data.r.1`	The calculated ranges of data.0
`bin`	The binary values for *out of control* equal to one and *under control* equal to zero, for X and R charts
`LX`	The X chart control limits vector
`LR`	The R chart control limits vector
`Limites Grafixa X`	The X chart control limits vector
`Limites Grafixa R`	The R chart control limits vector
`Conclusion del proceso`	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`xrs_gr` `X_it` `we_rules` `Cp_X`

Examples

```
data(dato2)
results1<-xrs_gr(dato2)
results2<-X_it(results1)
results3<-R_it(results2)
```

udata2 *Defective number per unit*

Description

The data give a nonconformities number on a clothes manufacturing process, the sample size is fixed.

Usage

```
data(udata2)
```

Format

A data frame with 90 observations and two variables.

`d` a numeric vector of integer number of nonconformities in a sample

`n` a numeric vector of sample size

Examples

```
require(XRSCC)
data(udata2)
u_gr(udata2)
```

u_gr *The u chart control for attributes*

Description

Calculates the *u* control chart for attributes, given a variable sample *n* and a number of nonconformities *u* per sample. The plotted values in graph are the average number of nonconformities per unit.

Usage

```
u_gr(U)
```

Arguments

`U`	A data frame containing the number *d* of nonconformities per sample, the sample *n* can be variable. Note that the variable names must be lowercase letter, say ***d*** and ***n***.

Value

`in.control`	The *under control* row list for the *u* chart
`out.control`	The *out of control* row list for the *u* chart
`Iteraciones`	The number of iterations, in this function always will be the first and the last one
`data.0`	The original data frame
`data.1`	Subsetting the data frame with *under control* rows
`bin`	The binary values for *out of control* equal to one and *under control* equal to zero
`Limites de Control Grafica \emph{u}`	The *u* chart control limits vector
`Conclusion del proceso`	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

p_gr, np_gr, c_gr, P_it, NP_it, C_it, U_it

Examples

```
data(udata2)
u_gr(udata2)
```

`U_it` *Iteration of u control chart for attributes*

Description

Calculates the iteration i'th for the control limits of *c* chart using the results obtained in `c_gr` and previous `U_it` iteration.

Usage

```
U_it(prev.results)
```

Arguments

`prev.results`	Is a list of previous results obtained by the `u_gr` function. In other cases, needs more than one iteration, to obtain the true control limits for *u* chart before take conclusions about the process.

Value

`in.control`	The *under control* row list for the *u* chart
`out.control`	The *out of control* row list for the *u* chart
`Iteraciones`	The number of iterations, in this function always will be the first and the last one
`data.0`	The original data frame
`data.1`	Subsetting the data frame with *under control* rows
`bin`	The binary values for *out of control* equal to one and *under control* equal to zero
`Limites de Control Grafica \emph{u}`	The *u* chart control limits vector
`Conclusion del proceso`	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`p_gr`, `np_gr`, `c_gr`, `u_gr`, `P_it`, `NP_it`, `C_it`

Examples

```
data(udata2)
r1<-u_gr(udata2)
r2<-U_it(r1)
```

`vol_sample` *Volume in ml*

Description

A volume sample in milliliters

Usage

```
data(vol_sample)
```

Format

A data frame with 100 subgroup of five observations

`n1` a numeric vector of volume

`n2` a numeric vector of volume

`n3` a numeric vector of volume

`n4` a numeric vector of volume

`n5` a numeric vector of volume

Examples

```
data(vol_sample)
require(XRSCC)
xrs_gr(vol_sample)
```

---

we_rules *Estimates the first four Western Electric Rules for detecting patterns*

Description

Estimates the first four Western Electric Rules for detecting patterns, starting with under control X chart obtained in the sequence `xrs_gr`, `X_it`, `R_it` functions. At the same time, plots the X chart including the zones above and below the central limit. For last, a binary value for each rule is presented if at least one rule is violated, '1' for 'yes', 0 for 'no'.

Usage

```
we_rules(prev.results)
```

Arguments

`prev.results`	Its a list of previous results obtained by the `xrs_gr` function in the first iteration, or a list of results obtained in further iterations by the `X_it`, and if necessary by the `R_it` function.

Details

The previous results may say that the process is under control, but, it's a conclusion concerning the first Western Electric rule only.

Value

`Resultados de analisis`
: A phrarse saying the process is or not under control

`Las siguientes reglas tienen al menos un grupo que viola la regla`
: The conclussion about the Western Electric rules from 1 to 4, showing a binary response, '1' for 'yes', 0 for 'no'.

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

SMALL, Bonnie B. (1956) *Statistical Quality Control Handbook*, 2th ed. Easton : Western Electric Co, Inc.

yhat *The Yhat Blog. Machine Learning, Data Science, Engineering*, [On line] http://blog.yhathq.com/posts/quality-control-in-r.html

See Also

xrs_gr, X_it, R_it, Cp_X

Examples

```
data(qqsugar)
results1<-xrs_gr(qqsugar)
results2<-R_it(results1)
we_rules(results2)
```

---

xrs_gr *Calculate and plot the X, R and S Charts for variable charts*

Description

Calculates the control limits for X, R and S charts, using a data frame with a fixed subgroup size. Plots the corresponding graph, the function estimates if any value is out of the control limits, returns a list with calculations.

Usage

```
xrs_gr(X)
```

Arguments

X	A sample in a dataframe object, with *m* rows like subgroups, and *n* columns like sample size.

Value

`in.control`	The *under control* row list for the X chart
`R.in.control`	The *under control* row list for the R chart
`out.control`	The *out of control* row list for the X chart
`Iteraciones`	The iterations number, the firts and the last one on this function
`data.0`	The original data frame
`data.1`	The *under control* subset after iteration
`data.r.1`	The calculated ranges of data.0
`bin`	The binary values for *out of control* equal to one and *under control* equal to zero, for X, R and S charts
`LX`	The X chart control limits vector
`LR`	The R chart control limits vector
`LS`	The S chart control limits vector
`Limites Grafixa X`	The X chart control limits vector
`Limites Grafixa R`	The R chart control limits vector
`Limites Grafixa S`	The S chart control limits vector
`Conclusion del proceso`	The same results in a phrase as the *bin* values

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control*, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3

See Also

`X_it`, `we_rules`, `R_it`, `Cp_X`, `Beta.X`

Examples

```
data(vol_sample)
results1<-xrs_gr(vol_sample)
```

X_it *Calculates the iteration i'th X Chart*

Description

With the results of xrs_gr followed by previous X_it iterations, the function calculates the X control limits charts, using a data frame with a fixed subgroup size *n*. In the graph plotting, the function estimates if any value (row or subgroup average) is out of control limits, and returns a list with calculations. Also, gives the R chart and control limits, which will be used in R_it function.

Usage

```
X_it(prev.results)
```

Arguments

prev.results	Is a list of previous results obtained by the xrs_gr function in the first iteration, or a list of results obtained in further iterations by the X_it function.

Details

The function stops if the X chart is under control already, and also stops if there is not any active graphic device.

Value

in.control	The *under control* row list for the X chart
R.in.control	The *under control* row list for the R chart
out.control	The *out of control* row list for the X chart
Iteraciones	The iterations number, It is assumed to be the second or later
data.0	The original data frame
data.1	The *under control* subset after iteration
data.r.1	The calculated ranges of data.0
bin	The binary values for *out of control* equal to one and *under control* equal to zero, for X and R charts
LX	The X chart control limits vector
LR	The R chart control limits vector
Limites Grafixa X	The X chart control limits vector
Limites Grafixa R	The R chart control limits vector
Conclusion del proceso	The same results in a phrase as the *bin* values

Note

For the true Range control limits calculation, use R_it.

Author(s)

Erick Marroquin

References

Montgomery, D.C. (2005) *Introduction to Statistical Quality Control, 5th ed. New York: John Wiley & Sons, ISBN 0-471-65631-3*

See Also

xrs_gr, R_it, Cp_X, we_rules

Examples

```
data(vol_sample)
results1<-xrs_gr(vol_sample)
results2<-X_it(results1)
```

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