Package 'OPDOE'

October 12, 2022

Version 1.0-10
Title Optimal Design of Experiments
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Description Several function related to Experimental Design are implemented here, see "Optimal Experimental Design with R" by Rasch D. et. al (ISBN 9781439816974).
Imports mytnorm, orthopolynom, nlme, crossdes, polynom
Depends gmp
License $GPL (>= 2)$
NeedsCompilation no
Repository CRAN
Date/Publication 2018-03-17 22:49:18 UTC
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cattle

Cattle data

Description

milk fat performance (in kg per lactation) of heifers of three sires from Holstein Frisian cattle to select the sire with the highest breeding value for milk fat performance.

Usage

```
data(cattle)
```

Format

The format is: num [1:5, 1:3] 132 128 135 121 138 173 166 172 176 169 ...

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

```
data(cattle)
size.seq_select.mean(data=cattle,delta=10, P=0.95)
```

design.reg.polynom 3

design.reg.polynom

Design for Polynomial Regression

Description

Determines locations and number of replications for a polynomial regression design.

Needs specification of order of polynom, borders of intervall and total number of measurements as input.

Usage

```
design.regression.polynom(a, b, k, n)
design.reg.polynom(...)
```

Arguments

a	lower bound of interval
b	upper bound of interval
k	order of polynom
n	total number of planned measurements
	only used for call wrapper design.reg.polynom

Details

Uses Legendre Polynomials to determine the support points for the design:

```
If a = -1, b = 1: places k + 1 support points in [-1, 1], located at the roots of (1 - x^2) \frac{dP_k(x)}{dx} where P_k(x) is the Legendre polynomial of degree k).
```

Distributes the n measurements almost equally over the support points.

Value

Object of class design.regression

Note

design.reg.polynomis a call wrapper for backward compatibility for design.regression.polynom

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

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Examples

```
x <- design.reg.polynom(10, 100, 3, 45)
x</pre>
```

design.regression

Regression Design Object

Description

An design.regression object is created with design.regression.polynom

Arguments

A triangular. test object is a list of

character, currently only "polynomial" is implemented

modelions choosen locations

replications choosen replications per location

interval vector of size 2 storing the given interval

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

design.regression.polynom

had

Stored Hadmard matrices

Description

Some stored Hadmard matrices, used in hadamard.matrix

Details

Stored matrices from http://www2.research.att.com/~njas/hadamard/ filling the gaps up to 256 in hadamard.matrix, 260 is the next gap.

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heights

male / female heights data

Description

Body heights of male and female students collected in a classroom experiment.

Usage

```
data(heights)
```

Format

A data frame with 7 observations on the following 2 variables.

```
female a numeric vector male a numeric vector
```

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

```
data(heights)
attach(heights)
tt <- triangular.test.norm(x=female[1:3],
    y=male[1:3], mu1=170,mu2=176,mu0=164,
    alpha=0.05, beta=0.2,sigma=7)
# Test is yet unfinished, add the remaining values:
tt <- update(tt,x=female[4:7], y=male[4:7])
# Test is finished now</pre>
```

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hemp

Hemp data

Description

age and height of hemp plants.

Usage

data(hemp)

Format

A data frame with 14 observations on the following 2 variables.

x a numeric vector

y a numeric vector

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

OPDOE-undocumented

(still) undocumented functions

Description

Undocumented / internal functions

Details

Some of these functions are not intended to be called by the user, others still lack their own documentation page. In the mean time see the referenced book.

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

print.design.regression 7

```
print.design.regression
```

Prints a regression design object

Description

Print method for a design.regression object.

Usage

```
## S3 method for class 'design.regression'
print(x, epl = 6, ...)
```

Arguments

```
x design.regression objectepl integer, entries per line... additional print arguments
```

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
design.regression
```

```
print.triangular.test Print method for Triangular Test Objects
```

Description

Prints a triangular. test object.

Usage

```
## S3 method for class 'triangular.test' print(x, ...)
```

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Arguments

x triangular.test object
... additional paramters for print

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
triangular.test.norm, triangular.test.prop
```

size.anova

Design of Experiments for ANOVA

Description

This function provides access to several functions returning the optimal number of levels and / or observations in different types of One-Way, Two-Way and Three-Way ANOVA.

Usage

```
size.anova(model, hypothesis = "", assumption = "",
    a = NULL, b = NULL, c = NULL, n = NULL, alpha, beta, delta, cases)
```

Arguments

model	A character string describing the model, allowed characters are (>x) and the letters abcABC, capital letters stand for random factors, lower case letters for fixed factors, x means cross classification, > nested classification, brackets () are used to specify mixed model, the term in brackets has to come first. Spaces are allowed.
	Examples: One-Way fixed: a, Two-Way: axB, a>b, Three-Way: axbxc, axBxC, a>b>c, (axb)>C,
hypothesis	Character string describiung Null hypothesis, can be omitted in most cases if it is clear that a test for no effects of factor A is performed, "a". Other possibilities: "axb", "a>b", "c" and some more.
assumption	Character string. A few functions need an assumption on sigma, like "sigma_AB=0,b=c", see the referenced book until this page is updated.
а	Number of levels of fixed factor A

size.anova 9

b	Number of levels of fixed factor B
С	Number of levels of fixed factor C
n	Number of Observations
alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined.

Details

see chapter 3 in the referenced book

Value

named integer giving the desired size(s)

Note

Depending on the selected model and hypothesis omit one or two of the sizes a, b, c, n. The function then tries to get its optimal value.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

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```
alpha=0.05, beta=0.1, delta=0.5, cases="maximin")
size.anova(model="axBxC",hypothesis="a",
           assumption="sigma_AC=0,b=c",a=6,n=2,
           alpha=0.05, beta=0.1, delta=0.5, cases="minimin")
size.anova(model="a>B>c", hypothesis="c",a=6, b=2, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="maximin")
size.anova(model="a>B>c", hypothesis="c",a=6, b=20, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="maximin")
size.anova(model="a>B>c", hypothesis="c",a=6, b=NA, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="maximin")
size.anova(model="(axb)>c", hypothesis="a",a=6, b=5, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="maximin")
size.anova(model="(axb)>c", hypothesis="a",a=6, b=5, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="minimin")
size.anova(model="(axb)>c", hypothesis="a",a=6, b=5, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="maximin")
size.anova(model="(axb)>c", hypothesis="a",a=6, b=5, c=4,
           alpha=0.05, beta=0.1, delta=0.5, case="minimin")
```

size_a.three_way

Three-way analysis of variance – mixed classification $(A \times B) \succ C$ model III and VII

Description

Returns the optimal number of levels for factor A (and B).

Usage

```
size_a.three_way_mixed_cxbina.model_3_c(alpha, beta, delta, b, c, n, cases)
size_a.three_way_mixed_cxbina.model_7_c(alpha, beta, delta, b, c, n, cases)
size_ab.three_way_mixed_cxbina.model_7_c(alpha, beta, delta, c, n, cases)
```

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
b	Number of levels of fixed factor B
С	Number of levels of fixed factor C
n	Number of replications
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

size_b.three_way

Details

see chapter 3 in the referenced book

Value

Integer(s) giving the size(s).

Note

Better use size anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

Examples

```
\label{eq:size_a.three_way_mixed_cxbina.model_3_c(0.05, 0.1, 0.5, 5, 4, 1, "maximin")} size_a.three_way_mixed_cxbina.model_3_c(0.05, 0.1, 0.5, 5, 4, 1, "minimin")} size_a.three_way_mixed_cxbina.model_7_c(0.05, 0.1, 0.5, 5, 4, 1, "maximin")} size_a.three_way_mixed_cxbina.model_7_c(0.05, 0.1, 0.5, 5, 4, 1, "minimin")} size_ab.three_way_mixed_cxbina.model_7_c(0.05, 0.1, 0.50, 5, 2, "maximin")} size_ab.three_way_mixed_cxbina.model_7_c(0.05, 0.1, 0.50, 5, 2, "minimin")}
```

```
\label{eq:continuous} \textit{Size\_b.three\_way} \  \  \, \textit{Three-way analysis of variance-nested and mixed classification} \  \, A \succ B \succ C \  \, \textit{and} \  \, (A \times B) \succ C \  \, \textit{model III, IV and VII}
```

Description

Returns the optimal number of levels for factor B.

Usage

```
size_b.three_way_mixed_ab_in_c.model_3_a(alpha, beta, delta, a, c, n, cases)
```

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Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
а	Number of levels of fixed factor A
С	Number of levels of fixed factor C
n	Number of replications
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

Value

Integer giving the size.

Note

Better use size. anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

```
 size\_b.three\_way\_mixed\_ab\_in\_c.model\_3\_a(0.05, 0.1, 0.5, 6, 5, 1, "maximin") \\ size\_b.three\_way\_mixed\_ab\_in\_c.model\_3\_a(0.05, 0.1, 0.5, 6, 5, 1, "minimin") \\ size\_b.three\_way\_mixed\_cxbina.model\_4\_a(0.05, 0.1, 0.5, 6, 4, 1, "maximin") \\ size\_b.three\_way\_mixed\_cxbina.model\_4\_a(0.05, 0.1, 0.5, 6, 4, 1, "minimin") \\ size\_b.three\_way\_mixed\_cxbina.model\_4\_c(0.05, 0.1, 0.5, 6, 4, 1, "maximin") \\ size\_b.three\_way\_mixed\_cxbina.model\_4\_c(0.05, 0.1, 0.5, 6, 4, 1, "minimin") \\ size\_b.three\_way\_mixed\_cxbina.model\_4\_axc(0.05, 0.1, 0.5, 6, 4, 1, "maximin") \\ size\_b.three\_way\_mixed\_cxbina.model\_4\_axc(0.05, 0.1, 0.5, 6, 4, 1, "minimin") \\ size\_b.three\_way\_nested.model\_6\_a(0.05, 0.1, 0.5, 6, 4, 2, "maximin") \\ size\_b.three\_way\_nested.model\_6\_a(0.05, 0.1, 0.5, 6, 4, 2, "minimin") \\ size\_b.three\_way\_nested.model\_6\_a(0.05, 0.1,
```

size_b.two_way

ize_b.two_way De	n for Two-Way ANOV	OVA

Description

Returns the optimal number of obervations per level of factor B.

Usage

```
size_b.two_way_cross.mixed_model_a_fixed_a(alpha, beta, delta, a, n, cases)
size_b.two_way_nested.b_random_a_fixed_a(alpha, beta, delta, a, cases)
```

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
а	Number of levels of fixed factor A
n	Number of replications
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

Value

Integer giving the size.

Note

Better use size. anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

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Examples

```
size_b.two_way_cross.mixed_model_a_fixed_a(0.05,0.1, 1, 6, 1, "maximin")
size_b.two_way_cross.mixed_model_a_fixed_a(0.05,0.1, 1, 6, 1, "minimin")
size_b.two_way_cross.mixed_model_a_fixed_a(0.05,0.1, 1, 6, 2, "maximin")
size_b.two_way_cross.mixed_model_a_fixed_a(0.05,0.1, 1, 6, 2, "minimin")
size_b.two_way_nested.b_random_a_fixed_a(0.05, 0.1, 1, 6, "maximin")
size_b.two_way_nested.b_random_a_fixed_a(0.05, 0.1, 1, 6, "minimin")
```

size_bc.three_way Three-way analysis of variance – $cross\ classification\ (A\ in\ B)\ x\ C$ – $model\ IV,\ Three$ -way analysis of variance – $mixed\ classification\ (A\ in\ B)\ x\ C\ model\ VI$

Description

Returns the optimal number of levels for factor B and C.

Usage

```
size_bc.three_way_cross.model_4_a_case1(alpha, beta, delta, a, n, cases)
size_bc.three_way_cross.model_4_a_case2(alpha, beta, delta, a, n, cases)
size_bc.three_way_mixed_cxbina.model_6_a_case1(alpha, beta, delta, a, n, cases)
size_bc.three_way_mixed_cxbina.model_6_a_case2(alpha, beta, delta, a, n, cases)
```

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
a	Number of levels of fixed factor A
n	Number of replications
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

Value

Integers giving the sizes.

Note

Better use size. anova which allows a cleaner notation.

size_c.three_way 15

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

Examples

```
size_bc.three_way_cross.model_4_a_case1(0.05, 0.1, 0.5, 6, 2, "maximin")
size_bc.three_way_cross.model_4_a_case1(0.05, 0.1, 0.5, 6, 2, "minimin")
size_bc.three_way_cross.model_4_a_case1(0.05, 0.1, 1, 6, 2, "maximin")
size_bc.three_way_cross.model_4_a_case1(0.05, 0.1, 1, 6, 2, "minimin")
size_bc.three_way_cross.model_4_a_case2(0.05, 0.1, 0.5, 6, 2, "maximin")
size_bc.three_way_cross.model_4_a_case2(0.05, 0.1, 0.5, 6, 2, "minimin")
size_bc.three_way_cross.model_4_a_case2(0.05, 0.1, 0.5, 6, 2, "maximin")
size_bc.three_way_cross.model_4_a_case2(0.05, 0.1, 1, 6, 2, "minimin")
size_bc.three_way_mixed_cxbina.model_6_a_case1(0.05, 0.1, 0.5, 6, 2, "maximin")
size_bc.three_way_mixed_cxbina.model_6_a_case2(0.05, 0.1, 0.5, 6, 2, "minimin")
size_bc.three_way_mixed_cxbina.model_6_a_case2(0.05, 0.1, 0.5, 6, 2, "maximin")
size_bc.three_way_mixed_cxbina.model_6_a_case2(0.05, 0.1, 0.5, 6, 2, "minimin")
```

size_c.three_way

Three-way analysis of variance – several cross-, nested and mixed classifications.

Description

Returns the optimal number of levels for .

Usage

```
size_c.three_way_cross.model_3_a
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_cross.model_3_axb
                                          (alpha, beta, delta, a, b, n, cases)
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_mixed_ab_in_c.model_5_a
size_c.three_way_mixed_ab_in_c.model_5_axb(alpha, beta, delta, a, b, n, cases)
size_c.three_way_mixed_ab_in_c.model_5_b
                                          (alpha, beta, delta, a, b, n, cases)
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_mixed_ab_in_c.model_6_b
size_c.three_way_mixed_cxbina.model_5_a
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_mixed_cxbina.model_5_b
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_mixed_cxbina.model_7_b
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_nested.model_5_a
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_nested.model_5_b
                                          (alpha, beta, delta, a, b, n, cases)
size_c.three_way_nested.model_7_b
                                          (alpha, beta, delta, a, b, n, cases)
```

size_c.three_way

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
а	Number of levels of fixed factor A
b	Number of levels of fixed factor B
n	Number of replications
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

Value

integer, desired size of factor C

Note

Better use size. anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

```
size_c.three_way_cross.model_3_a(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_cross.model_3_a(0.05, 0.1, 0.5, 6, 5, 2, "minimin")
size_c.three_way_cross.model_3_axb(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_cross.model_3_axb(0.05, 0.1, 0.5, 6, 5, 2, "minimin")
size_c.three_way_mixed_ab_in_c.model_5_a(0.05, 0.1, 0.5, 6, 5, 1, "maximin")
size_c.three_way_mixed_ab_in_c.model_5_a(0.05, 0.1, 0.5, 6, 5, 1, "minimin")
size_c.three_way_mixed_ab_in_c.model_5_axb(0.05, 0.1, 0.5, 6, 5, 1, "maximin")
size_c.three_way_mixed_ab_in_c.model_5_axb(0.05, 0.1, 0.5, 6, 5, 1, "minimin")
size_c.three_way_mixed_ab_in_c.model_5_axb(0.05, 0.1, 0.5, 6, 5, 1, "maximin")
```

```
size_c.three_way_mixed_ab_in_c.model_5_b(0.05, 0.1, 0.5, 6, 5, 1, "minimin")
size_c.three_way_mixed_ab_in_c.model_6_b(0.05, 0.1, 0.5, 6, 5, 1, "maximin")
size_c.three_way_mixed_ab_in_c.model_6_b(0.05, 0.1, 0.5, 6, 5, 1, "minimin")
size_c.three_way_mixed_cxbina.model_5_a(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_mixed_cxbina.model_5_a(0.05, 0.1, 0.5, 6, 5, 2, "minimin")
size_c.three_way_mixed_cxbina.model_5_b(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_mixed_cxbina.model_5_b(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_mixed_cxbina.model_7_b(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_mixed_cxbina.model_7_b(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_nested.model_5_a(0.05, 0.1, 0.5, 6, 5, 2, "maximin")
size_c.three_way_nested.model_5_a(0.05, 0.1, 0.5, 6, 5, 2, "minimin")
size_c.three_way_nested.model_5_b(0.05, 0.1, 0.5, 6, 5, 2, "minimin")
size_c.three_way_nested.model_7_b(0.05, 0.1, 0.5, 6, 4, 1, "maximin")
size_c.three_way_nested.model_7_b(0.05, 0.1, 0.5, 6, 4, 1, "minimin")
```

```
size_n.one_way.model_1
```

Design for One-Way ANOVA

Description

Returns the optimal number of obervations per level of factor A.

Usage

```
size_n.one_way.model_1(alpha, beta, delta, a, cases)
```

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
а	Number of levels of fixed factor A
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

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Value

Integer giving the size.

Note

Better use size anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

Examples

```
size_n.one_way.model_1(0.05,0.1, 2, 4, "maximin")
size_n.one_way.model_1(0.05,0.1, 2, 4, "minimin")
```

```
size_n.three_way
```

Design for Three-Way ANOVA

Description

Returns the optimal number of obervations per level of each factor.

Usage

```
(alpha, beta, delta, a, b, c, cases)
size_n.three_way_cross.model_1_a
size_n.three_way_cross.model_1_axb
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_cross.model_1_axbxc
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_ab_in_c.model_1_a
                                          (alpha, beta, delta, a, b, c, cases)
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_ab_in_c.model_1_b
size_n.three_way_mixed_ab_in_c.model_1_c
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_ab_in_c.model_3_c
                                          (alpha, beta, delta, a, b, c, cases)
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_ab_in_c.model_4_c
size_n.three_way_mixed_cxbina.model_1_a
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_cxbina.model_1_axc (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_cxbina.model_1_b
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_cxbina.model_1_bxc (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_cxbina.model_1_c
                                          (alpha, beta, delta, a, b, c, cases)
size_n.three_way_mixed_cxbina.model_3_b
                                          (alpha, beta, delta, a, b, c, cases)
```

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```
size_n.three_way_mixed_cxbina.model_3_bxc (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_1_a (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_1_c (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_3_b (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_3_c (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_4_a (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_4_a (alpha, beta, delta, a, b, c, cases)
size_n.three_way_nested.model_8_c (alpha, beta, delta, a, b, c, cases)
```

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
а	Number of levels of fixed factor A
b	Number of levels of fixed factor B
С	Number of levels of fixed factor C
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

Value

Integer giving the size.

Note

Better use size.anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

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```
size_n.three_way_cross.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_cross.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_cross.model_1_axb(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_cross.model_1_axb(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_cross.model_1_axbxc(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_cross.model_1_axbxc(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_ab_in_c.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_ab_in_c.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_ab_in_c.model_1_axb(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_ab_in_c.model_1_axb(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_ab_in_c.model_1_b(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_ab_in_c.model_1_b(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_ab_in_c.model_1_c(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
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size_n.three_way_mixed_ab_in_c.model_3_c(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_ab_in_c.model_4_c(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_ab_in_c.model_4_c(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_cxbina.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_cxbina.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
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size_n.three_way_mixed_cxbina.model_1_axc(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
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size_n.three_way_mixed_cxbina.model_1_b(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_cxbina.model_1_bxc(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_cxbina.model_1_bxc(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_cxbina.model_1_c(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_cxbina.model_1_c(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_cxbina.model_3_b(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_cxbina.model_3_b(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_mixed_cxbina.model_3_bxc (0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_mixed_cxbina.model_3_bxc (0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size\_n.three\_way\_nested.model\_1\_a(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_nested.model_1_a(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_nested.model_1_b(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_nested.model_1_b(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_nested.model_1_c(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_nested.model_1_c(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_nested.model_3_b(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_nested.model_3_b(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_nested.model_3_c(0.05, 0.1, 0.5, 6, 5, 4, "maximin")
size_n.three_way_nested.model_3_c(0.05, 0.1, 0.5, 6, 5, 4, "minimin")
size_n.three_way_nested.model_4_c(0.05, 0.1, 0.5, 6, NA, 4, "maximin")
size_n.three_way_nested.model_4_c(0.05, 0.1, 0.5, 6, NA, 4, "minimin")
size\_n.three\_way\_nested.model\_8\_c(0.05, \ 0.1, \ 0.5, \ 6, \ 5, \ 4, \ "maximin")
size\_n.three\_way\_nested.model\_8\_c(0.05,\ 0.1,\ 0.5,\ 6,\ 5,\ 4,\ "minimin")
```

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Description

Returns the optimal number of obervations per level of factor A.

Usage

```
size_n.two_way_cross.model_1_a(alpha, beta, delta, a, b, cases)
size_n.two_way_cross.model_1_axb(alpha, beta, delta, a, b, cases)
size_n.two_way_nested.model_1_test_factor_a(alpha, beta, delta, a, b, cases)
size_n.two_way_nested.model_1_test_factor_b(alpha, beta, delta, a, b, cases)
size_n.two_way_nested.a_random_b_fixed_b(alpha, beta, delta, a, b, cases)
```

Arguments

alpha	Risk of 1st kind
beta	Risk of 2nd kind
delta	The minimum difference to be detected
а	Number of levels of fixed factor A
b	Number of levels of fixed factor B
cases	Specifies whether the "maximin" or "maximin" sizes are to be determined

Details

see chapter 3 in the referenced book

Value

Integer giving the size.

Note

Better use size. anova which allows a cleaner notation.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt, Minghui Wang

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
size.anova
```

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Examples

```
size_n.two_way_cross.model_1_a(0.05,0.1, 1, 6, 4, "maximin")
size_n.two_way_cross.model_1_a(0.05,0.1, 1, 6, 4, "minimin")
size_n.two_way_cross.model_1_axb(0.05,0.1, 1, 6, 4, "maximin")
size_n.two_way_cross.model_1_axb(0.05,0.1, 1, 6, 4, "minimin")
size_n.two_way_nested.model_1_test_factor_a(0.05, 0.1, 1, 6, 4, "minimin")
size_n.two_way_nested.model_1_test_factor_a(0.05, 0.1, 1, 6, 4, "minimin")
size_n.two_way_nested.a_random_b_fixed_b(0.05, 0.1, 1, 2, 10, "maximin")
size_n.two_way_nested.a_random_b_fixed_b(0.05, 0.1, 1, 2, 10, "minimin")
size_n.two_way_nested.a_random_b_fixed_b(0.05, 0.1, 1, 3, 10, "maximin")
size_n.two_way_nested.a_random_b_fixed_b(0.05, 0.1, 1, 3, 10, "minimin")
size_n.two_way_nested.a_random_b_fixed_b(0.05, 0.1, 1, 10, 10, "maximin")
size_n.two_way_nested.a_random_b_fixed_b(0.05, 0.1, 1, 10, 10, "minimin")
```

triangular.test

Triangular Test Object

Description

An triangular.test object is created with triangular.test.norm or triangular.test.prop

Arguments

```
A triangular. test object is a list of
                  data for group 1
                  data for group 2
у
                  size of group 1
                  size of group 2
                  risk of 1st kind
alpha
beta
                  risk of 2nd kind
dist
                  character, either "normal" or "bernoulli", describing the type of triangiular
                  character, "one" or "two"
sample
                  character, "one-sided" or "two-sided"
kind
                  parameter describing the Null hypothesis, see triangular.test.prop
p0
p1
p2
mu0
                  parameter describing the Null hypothesis, see triangular.test.norm
mu1
mu2
                  character, outcome of the test, "H0" or "H1"
result
                  total number of steps and some more components for internal use.
step
```

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Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
triangular.test.norm, triangular.test.prop
```

Description

Performs a sequential test, compares means of two normally distributed groups.

Usage

```
triangular.test.norm(x, y = NULL, mu0 = NULL, mu1, mu2 = NULL, delta = NULL, sigma = NULL, sigma2 = NULL, alpha = 0.05, beta = 0.1, plot = TRUE)
```

Arguments

Х	initial data for group x, at least 1 entry.
У	initial data for group y, at least 1 entry for a two sample test, otherwise omitted.
mu0	specifies Null and alternative hypothesis, see Details below.
mu1	specifies Null and alternative hypothesis, see Details below.
mu2	specifies Null and alternative hypothesis, see Details below.
delta	The minimum difference to be detected, alternative way to specify $mu2=m1+delta$, see above, use either this or $mu2$.
sigma	prior sigma.
sigma2	prior sigma for group 2 if different than for group 1.
alpha	Risk of 1st kind
beta	Risk of 2nd kind
plot	logical, indicates whether a initial plot should be generated.

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Details

```
One-sample:
```

```
This function performs a one- or two-sided sequential Test for \mu= mu1 versus \mu> mu2, if mu2 > mu1 (one-sided) \mu< mu2, if mu2 < mu1 (one-sided) \mu< mu0 or \mu> mu2, if mu2 > mu1 and mu0 < mu1 (two-sided, possibly unsymmetric) Two-sample: This function performs a one- or two-sided sequential Test for equal means \mu_1= mu1 \mu_2= mu1 in both groups versus \mu_2> mu2, if mu2 > mu1 (one-sided) \mu_2< mu2, if mu2 < mu1 (one-sided) \mu_2< mu0 or \mu_2> mu2, if mu2 > mu1 and mu0 < mu1 (two-sided, possibly unsymmetric)
```

Value

An object of class triangular. test, to be used for later update steps.

Note

A two-sided test may be specified by supplying both mu1 and mu2, even unsymmetric if needed.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
triangular.test, triangular.test.prop, update.triangular.test
```

```
data(heights)
attach(heights)
# a symmetric two sided alternative:
tt <- triangular.test.norm(x=female[1:3],
    y=male[1:3], mu1=170,mu2=176,mu0=164,
    alpha=0.05, beta=0.2,sigma=7)
# Test is yet unfinished, add the remaining values step by step:
tt <- update(tt,x=female[4])
tt <- update(tt,y=male[4])
tt <- update(tt,x=female[5])
tt <- update(tt,y=male[5])</pre>
```

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```
tt <- update(tt,x=female[6])
tt <- update(tt,y=male[6])
tt <- update(tt,x=female[7])
tt <- update(tt,y=male[7])
# Test is finished now
# an unsymmetric two sided alternative:
tt2 <- triangular.test.norm(x=female[1:3],
    y=male[1:3], mu1=170,mu2=180,mu0=162,
    alpha=0.05, beta=0.2,sigma=7)
tt2 <- update(tt2,x=female[4])</pre>
```

triangular.test.prop Triangular Test for Bernoulli Data

Description

Performs a sequential test, compares probabilities in two groups.

Usage

```
triangular.test.prop(x, y = NULL, p0 = NULL, p1 = NULL, p2 = NULL, alpha = 0.05, beta = 0.1, delta = NULL, plot = TRUE)
```

Arguments

X	initial data for group x, at least 1 entry, values restricted to 0 and 1.
у	initial data for group y, at least 1 entry for a two sample test, otherwise omitted, values restricted to 0 and 1 .
р0	specifies Null and alternative hypothesis, see Details below.
p1	specifies Null and alternative hypothesis, see Details below.
p2	specifies Null and alternative hypothesis, see Details below.
alpha	Risk of 1st kind
beta	Risk of 2nd kind
plot	logical, indicates whether a initial plot should be generated.
delta	The minimum difference to be detected, alternative way to specify p2=p1+delta, see above, use either this or p2.

Details

One-sample:

```
This function performs a one- or two-sided sequential Test for p=p1 versus p>p2, if p2>p1 (one-sided) p<p2, if p2<p1 (one-sided) p<p0 or p>p2, if p2>p1 and p0<p1 (two-sided, possibly unsymmetric)
```

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Two-sample:

This function performs a one- or two-sided sequential Test for equal proportions $p_1 = p1$ $p_2 = p1$ versus

```
p_2> p2, if p2 > p1 (one-sided) p_2< p2, if p2 < p1 (one-sided) p_2< p0 or p_2> p2, if p2 > p1 and p0 < p1 (two-sided, possibly unsymmetric)
```

Value

An object of class triangular. test, to be used for later update steps.

Note

A two-sided test may be specified by supplying both p1 and p2, even unsymmetric if needed.

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
triangular.test, triangular.test.norm, update.triangular.test
```

```
data(heights)
attach(heights)
male180 <- as.integer(male>180)
female164 <- as.integer(female>164)
sum(male180)/length(male180)
tt <- triangular.test.prop(x=female164[1:3],
    y=male180[1:3], p1=0.4,p2=0.8,p0=0.1,
    alpha=0.05, beta=0.2)
tt <- update(tt,x=female164[4])
tt <- update(tt,y=male180[4])
tt <- update(tt,x=female164[5])
sum(female164)/length(female164)</pre>
```

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```
update.triangular.test\\
```

Print method for Triangular Test Objects

Description

Updates a triangular. test object and executes one or more steps in the sequence of tests.

Usage

```
## S3 method for class 'triangular.test'
update(object, x=NULL, y=NULL, initial=FALSE,
plot="last", recursive=FALSE, ...)
```

Arguments

object	triangular.test object
x	data for group 1
У	data for group 2
initial	logical, used internally for creating a triangular.test object
plot	character, "all": plot all intermediate steps, "last": plot only the last state
recursive	logical, used internally to decide wether a plot should be generated (will be omitted if recursively called)
	additional parameters for update

Author(s)

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt

References

Dieter Rasch, Juergen Pilz, L.R. Verdooren, Albrecht Gebhardt: Optimal Experimental Design with R, Chapman and Hall/CRC, 2011

See Also

```
triangular.test.norm, triangular.test.prop
```

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