Package ‘Crossover’

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Type Package
Title Analysis and Search of Crossover Designs
Version 0.1-18
Author Kornelius Rohmeyer
Maintainer Kornelius Rohmeyer <rohmeyer@small-projects.de>
Description Package Crossover provides different crossover designs from combinatorial or search algorithms as well as from literature and a GUI to access them.
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LinkingTo Rcpp (>= 0.10.3), RcppArmadillo (>= 0.2.0)
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This package provides more than two hundred cross-over designs from literature, a search algorithm to find efficient cross-over designs for various models and a graphical user interface to find/generate appropriate designs.

Description

This package provides more than two hundred cross-over designs from literature, a search algorithm to find efficient cross-over designs for various models and a graphical user interface to find/generate appropriate designs.

Author(s)

Maintainer: Kornelius Rohmeyer <rohmeyer@small-projects.de>

References


buildSummaryTable

Build Summary Table For All Examples From Literature

Description

Build Summary Table For All Examples From Literature

Usage

buildSummaryTable(extended = FALSE)

Arguments

extended If TRUE the summary table will have further columns with extended information as how balanced the design is and whether all treatment effect differences are estimable under all models.

Details

See also the documentation for the data files.

Value

TODO

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

References

See the documentation for the data files.

Examples

buildSummaryTable()
canonicalOrder

Sorts sequences of a design into a canonical order.

**Usage**

`canonicalOrder(design)`

**Arguments**

- `design` : Cross-over design.

**Details**

When comparing bigger designs this ordering easily allows to check whether two designs are equal.

**Author(s)**

Kornelius Rohmeyer <rohmeyer@small-projects.de>

**Examples**

```r
getDesign("switchback5t")
canonicalOrder(getDesign("switchback5t"))
```

contrMat2

Create the design matrix, variance-covariance matrix, the variance of each pairwise comparison and the efficiency of each pairwise comparison for a cross-over design.

**Description**

Function to read in a cross-over design and create the design matrix X, the variance of each pairwise comparison and the efficiency of each pairwise comparison.

**Usage**

```r
centrMat2(type, v, model, eff.factor = rep(1, length(parameterCount(model, v))))
```
Arguments

- **type**: Type of contrast. A character vector containing the following: "Dunnett", "Tukey", "none". If the length is 1, this contrast is only applied for the treatment effects and for carry-over effects a "Tukey" contrast is used. Otherwise the specified contrasts are used, see also the examples.

- **v**: Number of treatments

- **model**: Model - one of the following: 1) "Standard additive model", 2) "Second-order carry-over effects", 3) "Full set of interactions", 4) "Self-adjacency model", 5) "Placebo model", 6) "No carry-over into self model", 7) "Treatment decay model", 8) "Proportionality model", 9) "No carry-over effects". Can be specified as number or as character string.

- **eff.factor**: Weight applied to the different sub contrast matrices. A warning is given if it does not sum up to one. See examples.

Details

See the vignette of this package for further details.

Value

A contrast matrix

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

Examples

```r
contrMat2("Tukey", v=3, model=1)
contrMat2("Dunnett", v=3, model=1)
contrMat2(c("Dunnett", "Dunnett"), v=3, model=1)
contrMat2(c("Dunnett", "none"), v=3, model=1)
contrMat2(c("Dunnett", "none", "none"), v=3, model=8)
contrMat2("Dunnett", v=3, model=1, eff.factor=c(0.9, 0.1))
contrMat2("Dunnett", v=3, model=8, eff.factor=c(0.5, 0.3, 0.2))
```

CrossoverDesign-class

**Description**

A S4 class for Crossover designs: CrossoverDesign
Slots

- **list("design")**: Matrix specifying the design. Rows represent periods and columns the subjects.
- **list("s")**: Number of sequences.
- **list("p")**: Number of periods.
- **list("v")**: Number of treatments.
- **list("model")**: A numeric specifying the model the design was searched for or -1 if unknown.
- **list("description")**: Optional description of design or reference.
- **list("attr")**: List with attributes.
- **list("misc")**: List with miscellaneous stuff - not used yet.

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

Examples

design <- t(rbind(c(1,1,2,2),
                   c(2,2,1,1),
                   c(1,1,2,2),
                   c(2,2,1,1),
                   c(1,2,2,1),
                   c(2,1,1,2)))

new("CrossoverDesign", design)

---

### Crossoverdesigns

Selected Cross-Over designs from literature

---

Description

Selected Cross-Over designs from literature.

You can access all designs via the function getDesign as in the example getDesign("williams4t").

Format

A integer matrix specifying the design. Rows represent periods and columns the subjects.
Details

These data sets are stored combined by prefix, so alternatively to using the recommended function 
getDesign you could access for example design fletcher10 by using the command data(fletcher10) 
and afterwards all 31 design from fletcher1 up to fletcher31 are loaded.

The available data sets are:

federerAtkinson3ta, federerAtkinson3tb, federerAtkinson4ta, federerAtkinson4tb, federerAtkinson5ta, 
fletcher1, fletcher10, fletcher11, fletcher12, fletcher13, fletcher14, fletcher15, fletcher16, fletcher17, 
fletcher18, fletcher19, fletcher2, fletcher20, fletcher21, fletcher22, fletcher23, fletcher24, fletcher25, 
fletcher26, fletcher27, fletcher28, fletcher29, fletcher3, fletcher30, fletcher31, fletcher4, fletcher5, 
fletcher6, fletcher7, fletcher8, fletcher9, iqbalJones1, iqbalJones10, iqbalJones11, iqbalJones12, 
iqbalJones13, iqbalJones14, iqbalJones15, iqbalJones16, iqbalJones17, iqbalJones18, iqbalJones19, 
iqbalJones2, iqbalJones20, iqbalJones21, iqbalJones22, iqbalJones23, iqbalJones24, iqbalJones25, 
iqbalJones26, iqbalJones27, iqbalJones28, iqbalJones29, iqbalJones3, iqbalJones30, iqbalJones31, 
iqbalJones32, iqbalJones33, iqbalJones34, iqbalJones35, iqbalJones36, iqbalJones37, iqbalJones38, 
iqbalJones39, iqbalJones4, iqbalJones40, iqbalJones41, iqbalJones42, iqbalJones5, iqbalJones6, 
iqbalJones7, iqbalJones8, iqbalJones9, lewisFletcherMatthews1, lewisFletcherMatthews10, lewis- 
FletcherMatthews11, lewisFletcherMatthews12, lewisFletcherMatthews13, lewisFletcherMatthews14, 
lewisFletcherMatthews15, lewisFletcherMatthews16, lewisFletcherMatthews17, lewisFletcherMatthews18, 
lewisFletcherMatthews19, lewisFletcherMatthews2, lewisFletcherMatthews20, lewisFletcherMatthews3, 
lewisFletcherMatthews4, lewisFletcherMatthews5, lewisFletcherMatthews6, lewisFletcherMatthews7, 
lewisFletcherMatthews8, lewisFletcherMatthews9, orthogonalLatinSquare3t, orthogonalLatinSquare4t, 
orthogonalLatinSquare5t, orthogonalLatinSquare7t, pattersonLucasExtraPeriod30, pattersonLuca- 
sExtraPeriod31, pattersonLucasExtraPeriod32, pattersonLucasExtraPeriod33, pattersonLucasExtra-
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pattersonLucasExtraPeriod41, pattersonLucasExtraPeriod42, pattersonLucasExtraPeriod43, patterson-
LucasExtraPeriod44, pattersonLucasExtraPeriod45, pattersonLucasExtraPeriod46, pattersonLu-
casExtraPeriod47, pattersonLucasExtraPeriod48, pattersonLucasExtraPeriod49, pattersonLucasEx-
traPeriod86, pattersonLucasPBIBD100, pattersonLucasPBIBD101, pattersonLucasPBIBD102, patterson-
LucasPBIBD103, pattersonLucasPBIBD104, pattersonLucasPBIBD105, pattersonLucasPBIBD106, 
pattersonLucasPBIBD107, pattersonLucasPBIBD125, pattersonLucasPBIBD126, pattersonLucasP-
BIBD127, pattersonLucasPBIBD128, pattersonLucasPBIBD131, pattersonLucasPBIBD132, patterson-
LucasPBIBD133, pattersonLucasPBIBD134, pattersonLucasPBIBD135, pattersonLucasPBIBD136, 
pattersonLucasPBIBD137, pattersonLucasPBIBD138, pattersonLucasPBIBD139, pattersonLucasP-
BIBD140, pattersonLucasPBIBD141, pattersonLucasPBIBD153, pattersonLucasPBIBD154, patterson-
LucasPBIBD155, pattersonLucasPBIBD156, pattersonLucasPBIBD99, pattersonLucasPltT1, patterson-
LucasPltT10, pattersonLucasPltT12, pattersonLucasPltT13, pattersonLucasPltT15, patterson-
LucasPltT16, pattersonLucasPltT17, pattersonLucasPltT18, pattersonLucasPltT19, patterson-
LucasPltT20, pattersonLucasPltT21, pattersonLucasPltT22, pattersonLucasPltT23, pattersonLucas-
PltT3, pattersonLucasPltT4, pattersonLucasPltT5, pattersonLucasPltT7, pattersonLucasPltT8, patterson-
LucasPltT9, pidgeon1, pidgeon10, pidgeon11, pidgeon12, pidgeon13, pidgeon14, pidgeon15, 
pidgeon16, pidgeon17, pidgeon18, pidgeon19, pidgeon2, pidgeon20, pidgeon3, pidgeon4, pidge-
on5, pidgeon6, pidgeon7, pidgeon8, pidgeon9, prescott1, prescott2, quenouille3t1, quenouille3t2, 
quenouille4t1, quenouille4t2, quenouille4t3, russel4t, russel7t, switchback3t, switchback4t, switch-
back5t, switchback6t, switchback7t, williams3t, williams4t, williams5t, williams6t, williams7t, 
williams8t, williams9t, pb2.64.
Source


Examples

getDesign("williams4t")
data(fletcher)
ls(pattern="fletcher")
fletcher10

Description

Starts a graphical user interface for accessing and creating crossover designs.

Usage

CrossoverGUI()

Details

See the vignette of this package for further details, since describing a GUI interface is better done with some nice pictures.

Value

The function itself returns nothing of interest. But from the GUI designs and objects can be created or edited that will be available in R under the specified variable name after saving.

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

Examples

```r
## Not run:
CrossoverGUI()

## End(Not run)```
CrossoverSearchResult-class

Class CrossoverSearchResult

Description

A S4 class for the search result for Crossover designs: CrossoverSearchResult

Slots

list("design")  An object of class CrossoverDesign describing the best design that was found.
list("startDesigns")  A list of start designs to search from.
list("model")  A numeric specifying the model the design was searched for or -1 if unknown.
list("eff")  List, Progress of the algorithm. TODO: Explain further.
list("search")  List, TODO
list("time")  Named numeric with the time in seconds the algorithm was searching.
list("misc")  List - in the moment not used.

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

Examples

# n=c(100,10) is very small, but it's just an example and should not take much time
x <- searchCrossoverDesign(s=9, p=5, v=4, model=4, n=c(100,10))
print(x)

---
design.efficiency

Create the design matrix, variance-covariance matrix, the variance of each pairwise comparison and the efficiency of each pairwise comparison for a cross-over design

Description

Function to read in a cross-over design and create the design matrix X, the variance of each pairwise comparison and the efficiency of each pairwise comparison.

Usage

design.efficiency(design, model = 1, model.param = list(),
                  v = length(levels(as.factor(design)))))
Arguments

design Cross-over design.

model Model - one of the following: 1) "Standard additive model", 2) "Second-order carry-over effects", 3) "Full set of interactions", 4) "Self-adjacency model", 5) "Placebo model", 6) "No carry-over into self model", 7) "Treatment decay model", 8) "Proportionality model", 9) "No carry-over effects".

model.param List of additional model specific parameters. In the moment these are ppp, the proportionality parameter for the proportionality model, and placebos, the number of placebo treatments in the placebo model.

v Number of treatments

Details

See the vignette of this package for further details.

Value

A list with the following elements:

- xmat Design matrix for the given model (including subject and period effects)
- var.trt.pair.adj Matrix of treatment difference variances
- eff.trt.pair.adj Matrix of treatment difference efficiencies

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

References


Examples

design.efficiency(getDesign("fletcher1"))
design.efficiency(getDesign("fletcher1"), model=7)
design.efficiency(getDesign("switchback4t"), model=7)
exampleSearchResults2t

Example search results for two treatments

Description
A list of 16 integer matrices specifying the design. Rows represent periods and columns the subjects.

Format
A list of 16 integer matrices specifying the design. Rows represent periods and columns the subjects.

Details
See vignette.

Source
Found by method searchCrossOverDesign.

general.carryover   Calculate variances of parameter contrasts

Description
Calculate variances of parameter contrasts

Usage
general.carryover(design, v = length(table(design)), model, ppp = 0.5, placebos = 1, contrasts)

Arguments
  design        Cross-over design.
  v             Number of treatments
  model         Model - one of the following numbers or Strings: 1 = "Standard additive model", 2 = "Self-adjacency model", 3 = "Proportionality model", 4 = "Placebo model", 5 = "No carry-over into self model", 6 = "Treatment decay model", 7 = "Full set of interactions", 8 = "Second-order carry-over effects"
  ppp           The proportionality parameter for the proportionality model.
  placebos     The number of placebo treatments in the placebo model.
  contrasts     Optionally a contrast matrix or a list of contrast matrix. If missing pairwise differences for treatment and carry-over parameters are calculated.
getDesign

Details
See the vignette of this package for further details.

Value
A list with the variances of the pairwise differences or specified contrasts. If contrasts are not estimable, NA is returned for variances.

Author(s)
Kornelius Rohmeyer <rohmeyer@small-projects.de>

References

Examples

general.carryover(getDesign("fletcher1"), model=1)
general.carryover(getDesign("fletcher1"), model=2)
general.carryover(getDesign("fletcher1"), model=3)
general.carryover(getDesign("switchback4t"), model=7)

getDesign

Extract Design from a CrossoverSearchResult

Description
Extract Design from a CrossoverSearchResult

Usage
## S4 method for signature 'CrossoverSearchResult'
getDesign(object, ...)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>object</td>
<td>A searchCrossOverDesign object from which the design should be extracted.</td>
</tr>
<tr>
<td>...</td>
<td>Possible parameters for subclasses (not yet used).</td>
</tr>
</tbody>
</table>

Value
Returns a numeric matrix representing the crossover design. Rows represent periods, columns represent sequences.
Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

Examples

# n=c(100,10) is very small, but it's just an example and should not take much time
x <- searchCrossOverDesign(s=9, p=5, v=4, model=4, n=c(100, 10))
getDesign(x)

getDesign("williams4t")

---

getModelNr

*Get the number or character string specifying the model*

Description

Get the number or character string specifying the model

Usage

```r
getModelNr(model, type = "numeric")
```

Arguments

- `model` Number or character string specifying the model
- `type` Either "numeric" or "character". If numeric the number of the model will be returned. Otherwise the character string description of the model.

Value

Either number or character string specifying the model.

Examples

```r
Crossover::getModelNr("Self-adjacency model") == Crossover::getModelNr(2)  
"Self-adjacency model" == Crossover::getModelNr(2, type="character")  
Crossover::getModelNr("Self-adjacency model") == 2
```
Description

Plots information about the search algorithm and its process.

Usage

```r
## S4 method for signature 'CrossoverSearchResult,missing'
plot(x, y, type = 1,
     show.jumps = FALSE)
```

Arguments

- `x`: Result from searchCrossOverDesign.
- `y`: Missing.
- `type`: Type of plot. Number 1 is more colorful, but number 2 perhaps a bit easier to understand.
- `show.jumps`: If TRUE vertical lines will show where the specified jumps occurred.

Details

The x-axis corresponds to the consecutive simulation runs and the y-axis to the design criterion $E$ that depending on the model is either a weighted average of efficiency factors or standardized pairwise variances and described in detail in the vignette of this package. Also see the vignette for a few examples and a discussion what can be derived from this plots.

Value

Returns a ggplot object of the plot.

Author(s)

Kornelius Rohmeyer <rohmeyer@small-projects.de>

Examples

```r
## Not run:
x <- searchCrossOverDesign(s=9, p=5, v=4, model=4)
plot(x)

## End(Not run)

x <- searchCrossOverDesign(s=9, p=5, v=4, model=4, n=c(50,10), jumps=c(10, 10))
plot(x, show.jumps=TRUE)
plot(x, type=2)
```
rcd  Create a row column design

Description

Create a row column design

Usage

rcd(X, v, model)

Arguments

X   cross-over design
v   number of treatments
model   String or number describing the model. See `getModelNr`.

Value

A row-column design (as matrix - but not the design matrix).

See Also

`rcdMatrix` gives the row-column design matrix.

Examples

# TODO

rcdMatrix  Create the design matrix for a given row column design

Description

Create the design matrix for a given row column design

Usage

rcdMatrix(X, v, model)

Arguments

X   row-column design
v   number of treatments
model   String or number describing the model. See `getModelNr`.
**Value**

The design matrix for a row-column design.

**See Also**

`rcd` gives the row-column design to a given crossover design.

**Examples**

```r
c # TODO
```

---

**searchCrossOverDesign  Search for a Cross-Over Design**

**Description**

Search for a Cross-Over Design

**Usage**

```r
searchCrossOverDesign(s, p, v, model = "Standard additive model",
eff.factor = 1, v.rep, balance.s = FALSE, balance.p = FALSE,
verbose = 0, model.param = list(), n = c(5000, 20), jumps = c(5,
50), start.designs, random.subject = FALSE, contrast,
correlation = NULL, rho = 0)
```

**Arguments**

- `s`  
  Number of sequences.

- `p`  
  Number of periods.

- `v`  
  Number of treatments.

- `model`  
  Model - one of the following: "Standard additive model" (2), "Second-order carry-over effects" (3), "Full set of interactions" (3), "Self-adjacency model" (3), "Placebo model" (2), "No carry-over into self model" (2), "Treatment decay model" (2), "Proportionality model" (1), "No carry-over effects" (0). The number in parentheses is the number of different efficiency factors that can be specified.

- `eff.factor`  
  Weights for different efficiency factors. (Not used in the moment.)

- `v.rep`  
  Integer vector specifying how often each treatment should be assigned (sum must equal `s*p`).

- `balance.s`  
  Boolean specifying whether to allocate the treatments as equally as possible to each sequence (can result in loss of efficiency).

- `balance.p`  
  Boolean specifying whether to allocate the treatments as equally as possible to each period (can result in loss of efficiency).
searchCrossOverDesign

verbose
Level of verbosity, a number between 0 and 10. The default verbose=0 does not print any output, while verbose=10 prints any available notes.

model.param
List of additional model specific parameters. In the moment these are ppp, the proportionality parameter for the proportionality model, and placebos, the number of placebo treatments in the placebo model.

n
$n = c(n_1, n_2)$ with $n_1$ the number of hill climbing steps per trial and $n_2$ the number of searches from random start matrices.

jumps
To reduce the possibility of the hill-climbing algorithm to get stuck in local extrema long jumps of distance $d$ can be performed all $k$ steps. This can be specified as long.jumps = c(d,k). If long.jumps has only length 1 the default for $k$ is 50. If after $k/2$ hill-climbing steps the old design criterion is not enhanced (or at least reached), the algorithm returns to the design from before the jump.

start.designs
A single design or a list of start designs. If missing or to few start designs are specified (with regard to parameter $n$ which specifies a number of 20 start designs as default) the start designs are generated randomly with the sample function. Alternatively start.designs = "catalog" can be used to take start designs from the catalog to which random designs are added till $n_2$ start designs are at hand.

random.subject
Should the subject effects be random (random.subject=TRUE) or fixed effects (random.subject=FALSE).

contrast
Contrast matrix to be optimised. TODO: Example and better explanation for contrast.

correlation
Either a correlation matrix for the random subject effects or one of the following character strings: "equicorrelated", "autoregressive"

rho
Parameter for the correlation if parameter correlation is a character string.

Details
See the vignette of this package for further details.

Value
Returns the design as an integer matrix.

Author(s)
Kornelius Rohmeyer <rohmeyer@small-projects.de>

References
Examples

## Not run:
```
x <- searchCrossOverDesign(s=9, p=5, v=4, model=4)

jumps <- c(10000, 200)  # Do a long jump (10000 changes) every 200 steps
n <- c(1000, 5)        # Do 5 trials with 1000 steps in each trial
result <- searchCrossOverDesign(s=9, p=5, v=4, model=4, jumps=jumps, n=n)
plot(result)
```

## End(Not run)
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