

# Package ‘minimalRSD’

January 4, 2017

**Type** Package

**Title** Minimally Changed CCD and BBD

**Version** 1.0.0

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**Description** Generate central composite designs (CCD)with full as well as fractional factorial points (half replicate) and Box Behnken designs (BBD) with minimally changed run sequence.

**Imports** utils, stats

**License** GPL (>= 2)

**LazyData** TRUE

**RoxygenNote** 5.0.1

**NeedsCompilation** no

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**Repository** CRAN

**Date/Publication** 2017-01-04 11:21:29

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`fact.pts`*Generate Factorial Points*

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**Description**

For a given number of factors, say  $k$ , it generates  $2^k$  factorial points such that the number of changes in the run sequence is minimum.

**Usage**

```
fact.pts(k)
```

**Arguments**

$k$  an integer greater than or equal to 2.

**Value**

For  $K$  number of factors, generate factorial points with minimum level changes.

**Examples**

```
# For generating a full factorial for k=4 factors
# in 2 levels with minimum level changes
fact.pts(4)
```

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`fact.pts_2`*Generate Half Replicate of Full Factorial Points.*

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**Description**

For a given number of factors, say  $k$ , it generates  $2^{(k-1)}$  factorial points such that the number of changes in levels in the half replicate is minimum.

**Usage**

```
fact.pts_2(k)
```

**Arguments**

$k$  an integer greater than or equal to 3.

**Value**

For  $K$  number of factors, generate factorial points in half replication with minimum level changes.

## Examples

```
# For generating a minimally changed half  
# replicate of full factorial with 4 factors  
# in 2 levels fact.pts_2(4)
```

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minimalRSD

*minimalRSD: A package for constructing CCD and BBD with minimum level changes in the run sequence*

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## Description

The minimalRSD package can be used to construct Central Composite Designs (CCD) with full as well as fractional factorial points (half replicate) and Box Behnken designs (BBD) with minimum number of changes in the levels of input factors. These designs help in providing reducing cost-effective Response Surface Designs (RSDs). This package provides three categories of important functions: min-bbd, min\_ccd and min\_ccd\_2.

## Details

The package minimalRSD is an implementation of the concepts and theory discussed by Varghese et al. (2017). For detailed information and concepts users are advised to see the following reference.

## minimalRSD functions

min\_bbd: Generate minimally changed BBD for a given number of input factors.  
min\_ccd: Generate minimally changed CCD for a given number of input factors.  
min\_ccd\_2: Generate minimally changed CCD with fractional factorial points (half replicate) for a given number of factors.

## Author(s)

Shwetank Lall <shwetanklall@gmail.com>

## References

Eldho Varghese, Arpan Bhowmik, Seema Jaggi, Cini Varghese and Shwetank Lall (2017). On the construction of response surface designs with minimum level changes. *Utilitas Mathematica*, (under print).  
Eldho Varghese, Arpan Bhowmik, Seema Jaggi, Cini Varghese and Charanjit Kaur (2017). On the generation of cost effective response surface designs. *Computers and Electronics in Agriculture*, 133, 37-45.

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`min_bbd`*Minimally Changed BBD*

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**Description**

Generate Box Behnken design (BBD) with minimum level changes in the run sequence.

**Usage**

```
min_bbd(k)
```

**Arguments**

k                    An integer greter than or equal to 3.

**Value**

returns a minimally changed BBD for the number of input factors as v.

**Examples**

```
# To generate minimally changed BBD for k=4 factors
min_bbd(4)
```

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`min_ccd`*Minimally Changed CCD*

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**Description**

Generate minimally changed run sequence for central composite designs (CCD).

**Usage**

```
min_ccd(k)
```

**Arguments**

k                    an integer greater than or equal to 2.

**Value**

returns a minimally changed CCD for K number of factors with full factorial points.

**Examples**

```
# Generate minimally changed CCD with full factorial points
# for k=4 factors
min_ccd(4)
```

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min_ccd_2	<i>Generate Minimally Changed Central Composite designs (CCD) with Fractional Factorial Points (Half Replicate)</i>
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**Description**

Generate Minimally Changed Central Composite designs (CCD) with Fractional Factorial Points (Half Replicate)

**Usage**

```
min_ccd_2(k)
```

**Arguments**

k                    An integer greter than or equal to 3.

**Value**

returns a minimally changed CCD for K number of factors with half replicated factorial points.

**Examples**

```
# Generate minimally changed CCD with fractional
# factorial points (half replicate) for k=4 factors
min_ccd_2(4)
```

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num.ch	<i>Number of Changes in Factor Levels of the Design</i>
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**Description**

For a given design in matrix form, it counts the number of changes in levels of each factor as well as overall number of changes in the design.

**Usage**

```
num.ch(M)
```

**Arguments**

M                    a design matrix.

**Value**

returns the number of changes in levels of each factor and total number of such changes in the design

**Examples**

```
# For generating a minimally changed CCD with 4 factors
des<-min_ccd(4)
# To count the number of level changes in the generated design
num.ch(des$CCD_design)
```

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