Package 'PGM2'

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Type Package

Title Recursive Construction of Nested Resolvable Designs and Associated Uniform Designs

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Description Implements recursive construction methods for balanced incomplete block designs (BIBDs), their second generation, resolvable BIBDs (RBIBDs), and uniform designs (UDs) derived from projective geometries over GF(2). It enables extraction of nested structures in multiple stages and supports recursive resolution processes, as introduced in Boudraa et al. (2013).

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PGM2-package *PGM2: Recursive Construction of Nested Resolvable Designs and Associated Uniform Designs*

Description

Implements recursive construction methods for balanced incomplete block designs (BIBDs), their second generation, resolvable BIBDs (RBIBDs), and uniform designs (UDs) derived from projective geometries over GF(2). It enables extraction of nested structures in multiple stages and supports recursive resolution processes, as introduced in Boudraa et al. (2013).

Note

This work established in same time with the article intitled: Abla Boudraa et al., Recursive method for construction of nested resolvable designs and uniform designs associated, International Journal of Research and Reviews in Applied Sciences, (17), Issue 2 (2013).

Author(s)

Mohamed Laib, Abla Boudraa and Zebida Gheribi-Aoulmi

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References

D. Dugué Traité de statistique théorique et appliquée, Masson et Cie, 1958.

Gheribi-Aoulmi. Z and M. Bousseboua Recursive methods for construction of balanced n-ary block designs. Serdica Math.J (31), 2005,189-200

Fang.K.T et al., Constructions of uniform designs by using resolvable packings and coverings. Discrete Math. (19), 2003, 692-711.

Abla Boudraa, Zebida Gheribi-Aoulmi and Mohamed Laib. Recursive method for construction of nested resolvable designs and uniform designs associated. International Journal of Research and Reviews in Applied Sciences. Vol. 17, Issue 2 (2013).

Fang.K.T et al., Construction of uniform designs via super-simple resolvable t-designs. Util. Math. (66).2004, 15-32.

See Also

Useful links:

- https://mlaib.net

Examples

```
m<-4
X<-BIB(m)
n<-1
mat<-X$BIB
Y<-Resolvable(n,mat)   #Extract the RBIB
n<-1
mat<-X$BIB
X2<-Gen(n,mat)  #Extract the BIBD of the second generation
## Not run:
#Algorithm of the 3rd example in the paper : (Abla Boudraa & al) IJRRAS.
#(17), Issue 2 (2013).

bib<-BIB(3)$BIB
mat<-NULL
for(i in 1:15){mat[[i]]<-Gen(i,bib)$BIB2}
x<-Reduce("rbind",mat)
e<-dim(x)[1]
b<-dim(x)[2]
v<-bib[1,]
for (i in 1:e) {for (j in 1:b) {if (any (x[i,j]==v)) {x[i,j]<-0}}}
for (i in e:1) { if (all (x[i,]==0)) {x<-x[-i,]}}
s<-x[1,]
s<-s[s>0]
h<-length(s)
f<-dim(x)[1]
x1<-matrix(nrow=f, ncol=h)
for (i in 1:f) {x1[i,]<-x[i,][x[i,]>0]}
A<-unique(x1)
UD<-Uniform(A)

## End(Not run)
```

BIB *Balanced Incomplete binary Blocks Designs*

Description

Gives the configuration of a Balanced Incomplete binary Blocks Designs (BIBD) using a projective geometry on a Galois Field of order 2 GF(2).

Usage

```
BIB(m)
```

Arguments

m	Dimension of the projective geometry defined on GF(2)

Value

A LIST of:

1. [V] Number of treatments in the BIBD.
2. [B] Number of blocks of the BIBD.
3. [R] Repetition of each treatment.
4. [K] Size of each block.
5. [BIB] The configuration of the BIBD.

Author(s)

Mohamed Laib, Abla Boudraa and Zebida Gheribi-Aoulmi

References

D. Dugué Traité de statistique théorique et appliquée, Masson et Cie, 1958.

Examples

```
m<-4
X<-BIB(m)   #BIB from PG(4,2)
```

Gen *Balanced Incomplete binary Blocks Designs of second Generation.*

Description

Gives the configuration of a Balanced Incomplete binary Blocks Designs of seconde generation.

Usage

```
Gen(n, mat)
```

Arguments

n	The sub-variety of the block to be deleted.
mat	The matrix of the BIB.

Value

A LIST of:

1. [V] Number of treatments in the BIBD.
2. [B] Number of blocks of the BIBD.
3. [R] Repetition of each treatment.
4. [K] Size of each block.
5. [BIB] The configuration of the BIBD.

Author(s)

Mohamed Laib, Abla Boudraa and Zebida Gheribi-Aoulmi

References

D. Dugué Traité de statistique théorique et appliquée, Masson et Cie, 1958.

Examples

```
## Not run:
m<-4
X<-BIB(m)   #BIB from PG(4,2)

n<-1
mat<-X$BIB
X2<-Gen(n,mat) #Extracts the BIB second generation

## End(Not run)
```

`Resolvable` *Resolvable Balanced Incomplete Block Design RBIBD*

Description

Extracts the Resolvable Balanced Incomplete Block Design (RBIBD) of any BIBD constructed from a projective geometry.

Usage

```
Resolvable(n, mat)
```

Arguments

`n`	The sub-variety of the block to be deleted.
`mat`	The matrix of the BIB.

Value

A LIST of:

1. [V] Number of treatments in the RBIBD.
2. [B] Number of blocks of the RBIBD.
3. [R] Repetition of each treatment.
4. [K] Size of each block.
5. [BIB] The configuration of the RBIBD.

Author(s)

Mohamed Laib, Abla Boudraa and Zebida Gheribi-Aoulmi

References

D. Dugué Traité de statistique théorique et appliquée, Masson et Cie, 1958.

Examples

```
## Not run:
m<-4
X<-BIB(m)   #BIBD from PG(4,2)

n<-1
mat<-X$BIB
Y<-Resolvable(n,mat) #Extracts the RBIBD



## End(Not run)
```

`Steps` *Nested Resolvable Designs and associated Uniform Designs in different stages.*

Description

Gives the different stages of nested design begening from a projective geometry, BIBD, BIBD seconde generation, RBIBD and associated uniform designs.

Usage

```
Steps(m, n, stage = "all")
```

Arguments

`m`	Dimension of the projective geometry defined on GF(2).
`n`	The sub-variety of the block to be deleted.
`stage`	Stage of recurrence wanted (single value or vector) : 'all' Print all designs. 'S1' Print the configurations of BIB of first generation. 'S2' Print the configurations of BIB of seconde generation. 'S3' Print the configurations of RBIB. 'S4' Print the configurations of the uniform designs associate to each nested resolvable.

Value

A LIST, with the parametrs and the configurations on each stages of recurrence.

Author(s)

Mohamed Laib, Abla Boudraa and Zebida Gheribi-Aoulmi

References

Gheribi-Aoulmi. Z and M. Bousseboua Recursive methods for construction of balanced n-ary block designs. Serdica Math.J (31), 2005,189-200

Examples

```
## Not run:
list1<-Steps(4,1) #Get all stages : of the PG(4,2)

list2<-Steps(4,1,c('S1','S2')) #Get the 2 first stages : of the PG(4,2)

list3<-Steps(4,1,c('S1','S4')) #Get the first & the last stage : of the PG(4,2)

list4<-Steps(4,1,'S4') #Get the last stage : of the PG(4,2)

## End(Not run)
```

Uniform *Uniform designs*

Description

Builds the uniform design (UD) using a Resolvable Balanced Incomplete Block Design (RBIBD)

Usage

```
Uniform(mat)
```

Arguments

mat	The matrix of the RBIBD.

Value

A LIST of:

1. [n] Number of experiments.
2. [F] The dimension of the design.
3. [UD] The configuration of the uniform design.

Author(s)

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References

Fang.K.T et al., Constructions of uniform designs by using resolvable packings and coverings. Discrete Math. (19), 2003, 692-711.

Fang.K.T et al., Construction of uniform designs via super-simple resolvable t-designs. Util. Math. (66).2004, 15-32.

Examples

```
## Not run:

m<-4
X<-BIB(m)

n<-1
mat<-X$BIB
Y<-Resolvable(n,mat)

ud<-Uniform(Y$RBIB)  #Uniform design

## End(Not run)
```

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