Package ‘PBIBD’

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Type Package

Title Partially Balanced Incomplete Block Designs

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Author Parneet Kaur <parneet.nonu93@gmail.com>, Kush Sharma <kush.vashishtha@gmail.com>, Davinder Kumar Garg <dkgarg_stat@yahoo.co.in>

Maintainer Kush Sharma <kush.vashishtha@gmail.com>

Description It constructs four series of PBIB designs and also assists in calculating the efficiencies of PBIB Designs with any number of associate classes. This will help the researchers in adopting a PBIB designs and calculating the efficiencies of any PBIB design very quickly and efficiently.

License GPL (>= 2)

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Description

It constructs four series of PBIB designs and also assists in calculating the efficiencies of PBIB Designs with any number of associate classes. This will help the researchers in adopting a PBIB designs and calculating the efficiencies of any PBIB design very quickly and efficiently.

Details

The DESCRIPTION file:

Package: PBIBD
Type: Package
Title: Partially Balanced Incomplete Block Designs
Version: 1.2
Date: 2017-01-19
Author: Parneet Kaur <parneet.nonu93@gmail.com>, Kush Sharma <kush.vashishtha@gmail.com>, Davinder Kumar Garg <dkgarg_stat@yahoo.co.in>
Maintainer: Kush Sharma <kush.vashishtha@gmail.com>
Description: It constructs four series of PBIB designs and also assists in calculating the efficiencies of PBIB Designs with any number of associate classes.
License: GPL (>= 2)

Index of help topics:

PBIBD-package  Partially Balanced Incomplete Block Designs
apbibd  Calculates the efficiencies of PBIB designs with any number of associate classes.
apbibd2  Calculates the efficiencies of any two-associate class Partially Balanced Incomplete Block Designs
apbibd3  Calculates the efficiencies of any three-associate class Partially Balanced Incomplete Block Designs
apbibd4  Calculates the efficiencies of any four-associate class Partially Balanced Incomplete Block Designs
apbibd5  Calculates the efficiencies of any five-associate class Partially Balanced Incomplete Block Designs
series1  This function constructs five-associate class PBIB designs
series2  This function constructs five-associate class PBIB designs
series3  This function constructs five-associate class PBIB designs
This function constructs three-associate class PBIB designs.

Note
This package is currently under intensive development and changes are to be expected in the near future.

Author(s)
Parneet Kaur <parneet.nonu93@gmail.com>
Kush Sharma <kush.vashishtha@gmail.com>
Davinder Kumar Garg <dkgarg_stat@yahoo.co.in>
Maintainer: Kush Sharma <kush.vashishtha@gmail.com>

References

Description
This function calculates the different kinds of efficiencies and overall efficiency factor of Partially Balanced Incomplete Block Designs with any number of associate classes. The total number of treatments i.e. v, replications i.e. r, block size i.e. k, vector l of lambda's (lambda i being the ith element of vector l), vector n of number of associates (ni, i.e. number of ith associates, being the ith element of vector n), a list P of P-matrices of the association scheme of the design (Pi being the ith element of the list P) are to be supplied as input to the function.
Usage

apbibd(v, r, k, l, n, p)

Arguments

- **v**: Total number of treatments of the design
- **r**: Replication of the treatments in the design
- **k**: Block size of the design
- **l**: A vector containing lambda 1, lambda 2, lambda 3,..., lambda m as its first, second, third,..., mth elements
- **n**: A vector containing n1, n2, n3,..., nm as its first, second, third,..., mth elements
- **p**: A list containing P-matrices of the association scheme of the design such that P1 is its first element, P2 is second element, P3 is third element,..., Pm is the mth element

Value

Returns a list with (m+1) components:

- **E1**: Efficiency E1 of the design
- **E2**: Efficiency E2 of the design and so on...
- **Em**: Efficiency Em of the design
- **E**: Overall efficiency factor of the design

Author(s)

Kush Sharma, Parneet Kaur, Davinder Kumar Garg

Examples

```r
v<-25
r<-9
k<-9
l<-c(5,2,5,2,5)
n<-c(2,8,2,8,5)
P1<-matrix(c(0,0,1,0,0,0,0,4,1,0,1,0,0,0,4,0,4,0,0,0,0,0,0),nrow=5,ncol=5)
P2<-matrix(c(0,0,0,1,1,0,0,1,3,3,0,1,0,1,0,1,3,1,3,0,1,3,0,0,0),nrow=5,ncol=5)
P3<-matrix(c(1,0,1,0,0,4,0,4,0,1,0,0,0,0,4,0,4,0,0,0,4,0,0,4,0,4,0,4,0,0,4,0),nrow=5,ncol=5)
P4<-matrix(c(0,1,0,1,0,1,3,1,3,0,1,0,0,1,3,0,0,3,0,1,3,0,0,1,3,0,0,1,3,0),nrow=5,ncol=5)
P5<-matrix(c(0,2,0,0,2,6,0,0,0,0,0,2,0,0,0,2,6,0,0,0,0,0,0,0,2,6,0,0,0,0,0,3),nrow=5,ncol=5)
P<-list(P1,P2,P3,P4,P5)
apbibd(v,r,k,l,n,p)
```
apbibd2          Calculates the efficiencies of any two-associate class Partially Balanced Incomplete Block Designs

Description
This function calculates the different kinds of efficiencies and overall efficiency factor of any two-associate class Partially Balanced Incomplete Block Design. The total number of treatments i.e. \( v \), replications i.e. \( r \), block size i.e. \( k \), vector \( l \) of lambda 1 and lambda 2, vector \( n \) of number of associates i.e. \( n_1 \) and \( n_2 \), a list \( P \) of P-matrices of the association scheme of the design i.e. \( P_1 \) and \( P_2 \) are to be supplied as input to the function

Usage
apbibd2(v, r, k, l, n, P)

Arguments
- \( v \) Total number of treatments of the design
- \( r \) Replication of the treatments in the design
- \( k \) Block size of the design
- \( l \) A vector containing lambda 1 and lambda 2 as its first and second element
- \( n \) A vector containing \( n_1 \) and \( n_2 \) as its first and second element
- \( P \) A list containing P-matrices of the association scheme of the design such that \( P_1 \) is its first element and \( P_2 \) is the second element

Value
Returns a list with three components:

- Efficiency_E1 Efficiency E1 of the design
- Efficiency_E2 Efficiency E2 of the design
- Overall_Efficiency_Factor Overall efficiency factor of the design

Author(s)
Kush Sharma, Parneet Kaur, Davinder Kumar Garg

Examples
```r
v<-10
r<-6
k<-2
l<-c(1,0)
n<-c(6,3)
```
`apbibd3` is a function that calculates the efficiencies of any three-associate class Partially Balanced Incomplete Block Designs. It takes as input the total number of treatments (`v`), replication of the treatments (`r`), block size of the design (`k`), a vector containing lambda 1, lambda 2 and lambda 3 (`l`), a vector containing number of associates (n1, n2 and n3) (`n`), and a list of P-matrices of the association scheme of the design (`p`).

**Arguments**
- `v`: Total number of treatments of the design
- `r`: Replication of the treatments in the design
- `k`: Block size of the design
- `l`: A vector containing lambda 1, lambda 2 and lambda 3 as its first, second and third element
- `n`: A vector containing n1, n2 and n3 as its first, second and third element
- `p`: A list containing P-matrices of the association scheme of the design such that P1 is its first element, P2 is second element and P3 is the third element

**Value**
Returns a list with four components:
- `Efficiency_E1`: Efficiency E1 of the design
- `Efficiency_E2`: Efficiency E2 of the design
- `Efficiency_E3`: Efficiency E3 of the design
- `Overall_Efficiency_Factor`: Overall efficiency factor of the design

**Author(s)**
Kush Sharma, Parneet Kaur, Davinder Kumar Garg
Examples

v<-15
r<-9
k<-9
l<-c(4,5,6)
n<-c(2,8,5)
P1<-matrix(c(1,0,0,0,4,0,4,4,0,4,0),nrow=3,ncol=3)
P2<-matrix(c(0,1,1,1,3,1,3,1,3,3,1),nrow=3,ncol=3)
P3<-matrix(c(0,2,0,2,6,0,0,0,3),nrow=3,ncol=3)
P<-list(P1,P2,P3)
apbibd3(v,r,k,l,n,P)

apbibd4 Calculates the efficiencies of any four-associate class Partially Balanced Incomplete Block Designs

Description

This function calculates the different kinds of efficiencies and overall efficiency factor of any four-associate class Partially Balanced Incomplete Block Design. The total number of treatments i.e. v, replications i.e. r, block size i.e. k, vector l of lambda 1, lambda 2, lambda 3 and lambda 4, vector n of number of associates i.e. n1, n2, n3 and n4, a list P of P-matrices of the association scheme of the design i.e. P1, P2, P3 and P4 are to be supplied as input to the function

Usage

apbibd4(v, r, k, l, n, P)

Arguments

v Total number of treatments of the design
r Replication of the treatments in the design
k Block size of the design
l A vector containing lambda 1, lambda 2, lambda 3 and lambda 4 as its first, second, third and fourth elements
n A vector containing n1, n2, n3 and n4 as its first, second, third and fourth elements
P A list containing P-matrices of the association scheme of the design such that P1 is its first element, P2 is second element, P3 is third element and P4 is the fourth element
**Value**

Returns a list with five components:

- **Efficiency_E1**  Efficiency E1 of the design
- **Efficiency_E2**  Efficiency E2 of the design
- **Efficiency_E3**  Efficiency E3 of the design
- **Efficiency_E4**  Efficiency E4 of the design
- **Overall_Efficiency_Factor**  Overall efficiency factor of the design

**Author(s)**

Kush Sharma, Parneet Kaur, Davinder Kumar Garg

**Examples**

```r
v <- 12
r <- 2
k <- 3
l <- c(1, 0, 0, 0)
n <- c(4, 2, 4, 1)
P1 <- matrix(c(1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1), nrow = 4, ncol = 4)
P2 <- matrix(c(2, 0, 2, 0, 0, 0, 1, 2, 0, 2, 0, 0, 1, 0, 0, 1), nrow = 4, ncol = 4)
P3 <- matrix(c(1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0), nrow = 4, ncol = 4)
P4 <- matrix(c(0, 0, 4, 0, 0, 2, 0, 4, 0, 0, 0, 0, 0, 0, 0, 0), nrow = 4, ncol = 4)
P <- list(P1, P2, P3, P4)
apbibd5(v, r, k, l, n, P)
```

**Description**

This function calculates the different kinds of efficiencies and overall efficiency factor of any five-associate class Partially Balanced Incomplete Block Design. The total number of treatments i.e. v, replications i.e. r, block size i.e. k, vector l of lambda 1, lambda 2, lambda 3, lambda 4 and lambda 5, vector n of number of associates i.e. n1, n2, n3, n4 and n5, a list P of P-matrices of the association scheme of the design i.e. P1, P2, P3, P4 and P5 are to be supplied as input to the function

**Usage**

```r
apbibd5(v, r, k, l, n, P)
```
Arguments

v Total number of treatments of the design
r Replication of the treatments in the design
k Block size of the design
l A vector containing lambda 1, lambda 2, lambda 3, lambda 4 and lambda 5 as its first, second, third, fourth and fifth elements
n A vector containing n1, n2, n3, n4 and n5 as its first, second, third, fourth and fifth elements
p A list containing P-matrices of the association scheme of the design such that P1 is its first element, P2 is second element, P3 is third element, P4 is fourth element and P5 is the fifth element

Value

Returns a list with six components:

Efficiency_E1 Efficiency E1 of the design
Efficiency_E2 Efficiency E2 of the design
Efficiency_E3 Efficiency E3 of the design
Efficiency_E4 Efficiency E4 of the design
Efficiency_E5 Efficiency E5 of the design
Overall_Efficiency_Factor Overall efficiency factor of the design

Author(s)

Kush Sharma, Parneet Kaur, Davinder Kumar Garg

Examples

v<-25
r<-9
k<-9
l<-c(5,2,5,2,5)
n<-c(2,8,2,8,1)
p2<-matrix(c(P,P,P,1,1,P,P,1,3,3,P,1,P,1,P,1,3,1,3,P,1,3,P,P,1),nrow=5,ncol=5)
p4<-matrix(c(P,1,P,1,P,1,3,1,3,P,P,1,P,P,1,1,3,1,3,0,1,3,0,1,3,0),nrow=5,ncol=5)
p<-list(p1,p2,p3,p4,p5)
apbibd5(v,r,k,l,n,p)
series1

This function constructs five-associate class PBIB designs

Description

Let us consider a module M of residue class mod(5) having elements 0, 1, 2, 3, 4 and all the elements of M are assigned to each of the \( n \geq 2 \) classes. This function constructs PBIB designs with the following parameters: \( v = 5n \) \( b = 5n \) \( r = n+4 \) \( k = n+4 \) \( \lambda_1 = 5 \) \( \lambda_2 = 2 \) \( \lambda_3 = 5 \) \( \lambda_4 = 2 \) \( \lambda_5 = n \)

Usage

\texttt{series1(n)}

Arguments

\texttt{n} \hspace{1cm} n is the number of classes to which the elements of Module M are assigned

Value

The function returns the required PBIB design with specified parameters

Author(s)

Parneet Kaur, Kush Sharma, Davinder Kumar Garg

Examples

\texttt{series1(2)}

series2

This function constructs five-associate class PBIB designs

Description

Let us consider a module M of residue class mod(5) having elements 0, 1, 2, 3, 4 and all the elements of M are assigned to each of the \( n \geq 2 \) classes. This function constructs PBIB designs with the following parameters: \( v = 5n \) \( b = 5n \) \( r = n+3 \) \( k = n+3 \) \( \lambda_1 = 3 \) \( \lambda_2 = 1 \) \( \lambda_3 = 3 \) \( \lambda_4 = 2 \) \( \lambda_5 = n \)

Usage

\texttt{series2(n)}

Arguments

\texttt{n} \hspace{1cm} n is the number of classes to which the elements of Module M are assigned
Value

The function returns the required PBIB design with specified parameters.

Author(s)

Parneet Kaur, Kush Sharma, Davinder Kumar Garg

Examples

series2(4)

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series3

*This function constructs five-associate class PBIB designs*

Description

Let us consider a module M of residue class mod(5) having elements 0, 1, 2, 3, 4 and all the elements of M are assigned to each of the n >=2 classes. This function constructs PBIB designs with the following parameters:

- \( v = 5n \)
- \( b = 5n \)
- \( r = 2(n + 1) \)
- \( k = 2(n + 1) \)
- \( \lambda_1 = n + 2 \)
- \( \lambda_2 = n + 2 \)
- \( \lambda_3 = 3 \)
- \( \lambda_4 = 2 \)
- \( \lambda_5 = 2n \)

Usage

series3(n)

Arguments

- \( n \)
  - \( n \) is the number of classes to which the elements of Module M are assigned.

Value

The function returns the required PBIB design with specified parameters.

Author(s)

Parneet Kaur, Kush Sharma, Davinder Kumar Garg

Examples

series3(5)
This function constructs three-associate class PBIB designs.

**Description**

Let us consider a module M having m elements. To each element of the module there corresponds n distinct classes, where m >=5 and n>=2. With these v = mn treatments following are parameters of the three-associate class PBIB design: v = mn b = mn r = (m+n-1) k = (m+n-1) lambda 1 = m lambda 2 = 2 lambda 3 = n

**Usage**

```r
series4(m, n)
```

**Arguments**

- `m` Size of the module M
- `n` Number of classes

**Value**

This function returns the required three-associate class PBIB design.

**Author(s)**

Parneet Kaur, Kush Sharma, Davinder Kumar Garg

**Examples**

```r
series4(5,2)
```
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