Package ‘BDEsize’

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Type Package
Title Efficient Determination of Sample Size in Balanced Design of Experiments
Version 1.2
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Description Provides the sample size in balanced design of experiments and three graphs; detectable standardized effect size vs power, sample size vs detectable standardized effect size, and sample size vs power.
Sample size is computed in order to detect a certain standardized effect size with power at the significance level.
Three graphs show the mutual relationship between the sample size, power and the detectable standardized effect size.
By investigating those graphs, it can be checked that which effects are sensitive to the efficient sample size determination.
Lenth, R.V. (2006-9) <http://www.stat.uiowa.edu/~rlenth/Power>
Lim, Yong Bin (1998)
License GPL (>= 2)
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Repository CRAN
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Description

Shiny App for efficient determination of the size of experiments in Balanced design of experiments

Usage

BDEsizeApp()

Examples

#BDEsizeApp()

fsize

Detectable minimum effect size

Description

Detectable minimum effect size is calculated using the distribution function of noncentral F-distribution with noncentrality parameter.

Usage

fsize(alpha, beta, nu1, nu2, c, delta_type, flag)
plots.2levFr

**Arguments**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>alpha</td>
<td>Type I error</td>
<td></td>
</tr>
<tr>
<td>beta</td>
<td>Type II error</td>
<td></td>
</tr>
<tr>
<td>nu1</td>
<td>numerator degree of freedom for the f-test</td>
<td></td>
</tr>
<tr>
<td>nu2</td>
<td>denominator degree of freedom for the f-test</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>the coefficient of sum of squares</td>
<td></td>
</tr>
<tr>
<td>delta_type</td>
<td>type of standardized effect size ; 1 : standard deviation type, 2 : range of effect type</td>
<td></td>
</tr>
<tr>
<td>flag</td>
<td>In case of delta_type=2 ; If flag=1 , two-way interaction effect for range of effect type. If flag=0(default), main effect for range of effect type.</td>
<td></td>
</tr>
</tbody>
</table>

**Value**

detectable minimal effect sizes

**Examples**

```r
#two-level full factorial design with 2 factors
#5 replications, main effect for standardized type
fsize(alpha=0.05, beta=0.2, nu1=1, nu2=17,
c=10,delta_type=1 )
```

---

**Description**

Three graphs in 2 level fractional factorial design are for investigating the mutual relationship between the sample size, power "1-beta" and the detectable standardized effect size "delta"

**Usage**

```
plots.2levFr(factor,fraction,order,delta_type,delta,deltao,alpha,beta,type)
```

**Arguments**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>factor</td>
<td>the number of factor</td>
<td></td>
</tr>
<tr>
<td>fraction</td>
<td>the number of generators p ex) (2^k - p)</td>
<td></td>
</tr>
<tr>
<td>order</td>
<td>building the model with main or including the interaction effects ; 1 : only main effects(default) , 2 : both main and two-way interaction effects</td>
<td></td>
</tr>
<tr>
<td>delta_type</td>
<td>type of standardized effect size ; 1 : standard deviation type(default), 2 : range of effect type</td>
<td></td>
</tr>
</tbody>
</table>
plots.Block

Graphs for investigating sample size in randomized complete block design

Description

Three graphs in randomized complete block design are for investigating the mutual relationship between the sample size, power "1-beta" and the detectable standardized effect size "delta".

Usage

plots.Block(factor, factor.lev, order, delta_type, delta, deltao, alpha, beta, type)

Arguments

- factor: the number of factor
- factor.lev: factor levels
- order: building the model with main or including the interaction effects; 1: only main effects (default), 2: both main and two-way interaction effects
- delta_type: type of standardized effect size; 1: standard deviation type (default), 2: range of effect type
- delta: lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third column is standard deviation of noise.
- deltao: detectable standardized effect size for the sample size vs power plot (in case of type=3); 1 (default)
- alpha: Type I error; 0.05 (default)
- beta: Type II error; 0.20 (default)
- type: three graphs; If type=1, Delta vs Power plot. If type=2, Sample size vs Delta plot. If type=3, Sample size vs Power plot

Examples

# Delta vs Power plot
plots.2levFr(factor=3, fraction=1, order=1, delta_type=1, delta=c(1,0,1), alpha=0.05, beta=0.2, type=1)

# Sample size vs Power plot including two-way interaction effects
plots.2levFr(factor=5, fraction=1, order=2, delta_type=1, delta=c(1,1,1), deltao=1, alpha=0.05, beta=0.2, type=3)
**plots.Full**

- **delta**
  - lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third column is standard deviation of noise.

- **deltao**
  - deltao is the detectable standardized effect size for the sample size vs power plot (in case of type=3); 1 (default)

- **alpha**
  - Type I error; 0.05 (default)

- **beta**
  - Type II error; 0.20 (default)

- **type**
  - three graphs; If type=1, Delta vs Power plot. If type=2, Sample size vs Delta plot. If type=3, Sample size vs Power plot

**Value**

one of three graphs: Delta vs Power plot, Sample size vs Delta plot, and Sample size vs Power plot

**Examples**

# Delta vs Power plot
```r
plots.Block(factor=2, factor.lev=c(2,2), order=1, delta_type=1, delta=c(1,0,1), alpha=0.05, beta=0.2, type=1)
```

# Sample size vs Power plot including two-way interaction effects
```r
plots.Block(factor=2, factor.lev=c(2,2), order=2, delta_type=1, delta=c(1,1,1), deltao=1.5, alpha=0.05, beta=0.2, type=3)
```

---

**plots.Full**

*Graphs for investigating sample size in full factorial design*

**Description**

Three graphs in full factorial design are for investigating the mutual relationship between the sample size, power "1-beta" and the detectable standardized effect size "delta"

**Usage**

```r
plots.Full(factor, factor.lev, order, delta_type, delta, deltao, alpha, beta, type)
```

**Arguments**

- **factor**
  - the number of factor

- **factor.lev**
  - factor levels

- **order**
  - building the model with main or including the interaction effects; 1: only main effects (default), 2: both main and two-way interaction effects

- **delta_type**
  - type of standardized effect size; 1: standard deviation type (default), 2: range of effect type
delta lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third column is standard deviation of noise.
deltao deltao is the detectable standardized effect size for the sample size vs power plot (in case of type=3) ; 1 (default)
alpha Type I error ; 0.05 (default)
beta Type II error ; 0.20 (default)
type three graphs ; If type=1, Delta vs Power plot. If type=2, Sample size vs Delta plot. If type=3, Sample size vs Power plot

Value

one of three graphs ; Delta vs Power plot, Sample size vs Delta plot, and Sample size vs Power plot

Examples

#Delta vs Power plot in case of two-level full factorial design with 2 factors
plots.Full(factor=2, factor.lev=c(2,2),order=1,
delta_type=1, delta=c(1,0,1), alpha=0.05, beta=0.2, type=1)
#Sample size vs Power plot in case of two-level full factorial design with 2 factors
plots.Full(factor=2, factor.lev=c(2,2),order=2,
delta_type=1, delta=c(1,1,1), deltao=1.5, alpha=0.05, beta=0.2, type=3)
Sample size calculator for 2 level fractional factorial design

Description

Sample size in 2 level fractional factorial design is computed in order to detect a certain standardized effect size "delta" with power "1-beta" at the significance level "alpha". The model for fractional factorial design contains only main effects in resolution III and IV.

Usage

Size.2levFr(factor,fraction,order,delta_type,delta,alpha,beta)
Arguments

factor the number of factor
fraction the number of generators p ex) 2(k – p)
order building the model with main or including the interaction effects; 1 : only main effects (default), 2 : both main and two-way interaction effects
delta_type type of standardized effect size; 1 : standard deviation type (default), 2 : range of effect type
delta lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third column is standard deviation of noise.
alpha Type I error ; 0.05 (default)
beta Type II error ; 0.20 (default)

Value

model, optimal sample size and detectable standardized effect sizes
Detectable standardized effect sizes return only one or two values for main and two-way interaction effects.

References


Examples

#only main effects
A<-Size.2levFr(factor=3, fraction=1, order=1, delta_type=1, delta=c(1,0,1), alpha=0.05, beta=0.2)
A$model
A$n
A$Delta

#including two-way interaction effects
B<-Size.2levFr(factor=5, fraction=1, order=2, delta_type=1, delta=c(1,1,1), alpha=0.05, beta=0.2)
Sample size calculator for randomized complete block design

Description

Sample size in randomized complete block design is computed in order to detect a certain standardized effect size "delta" with power "1-beta" at the significance level "alpha".

Usage

Size.Block(factor,factor.lev,order,delta_type,delta,alpha,beta)

Arguments

factor the number of factor
factor.lev factor levels
order building the model with main or including the interaction effects ; 1 : only main effects(default) , 2 : both main and two-way interaction effects
delta_type type of standardized effect size ; 1 : standard deviation type(default), 2 : range of effect type
delta lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third column is standard deviation of noise.
alpha Type I error ; 0.05 (default)
beta Type II error ; 0.20 (default)

Value

model, optimal sample size and detectable standardized effect sizes

References


Examples

# only main effects
A <- Size.Block(factor = 2, factor.lev = c(2, 2), order = 1,
delta_type = 1, delta = c(1, 0, 1), alpha = 0.05, beta = 0.2)
A$model
A$n
A$Delta

# including two-way interaction effects
B <- Size.Block(factor = 2, factor.lev = c(2, 2), order = 2,
delta_type = 1, delta = c(1, 1, 1), alpha = 0.05, beta = 0.2)

---

Size.Full

Sample size calculator for full factorial design

Description

Sample size in full factorial design is computed in order to detect a certain standardized effect size "delta" with power "1-beta" at the significance level "alpha".

Usage

Size.Full(factor, factor.lev, order, delta_type, delta, alpha, beta)

Arguments

factor the number of factor
factor.lev factor levels
order building the model with main or including the interaction effects ; 1 : only main effects (default) , 2 : both main and two-way interaction effects
delta_type type of standardized effect size ; 1 : standard deviation type (default), 2 : range of effect type
delta lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third column is standard deviation of noise.
alpha Type I error ; 0.05 (default)
beta Type II error ; 0.20 (default)

Value

model, optimal sample size and detectable standardized effect sizes
References


Examples

```r
#only main effects
A<-Size.Full(factor=2, factor.lev=c(2,2), order=1, delta_type=1, delta=c(1,0,1), alpha=0.05, beta=0.2)
A$model
A$n
A$Delta

#including two-way interaction effects
B<-Size.Full(factor=2, factor.lev=c(2,2), order=2, delta_type=1, delta=c(1,1,1), alpha=0.05, beta=0.2)
```

Size.Split

Sample size calculator for split-plot design

Description

Sample size in split-plot design is computed in order to detect a certain standardized effect size "delta" with power "1-beta" at the significance level "alpha".

Usage

```
Size.Split(whole.factor, whole.factor.lev, split.factor, split.factor.lev, order, delta_type, delta, alpha, beta)
```

Arguments

- `whole.factor`: the number of whole factor
- `whole.factor.lev`: whole factor levels
- `split.factor`: the number of split factor
- `split.factor.lev`: split factor levels
- `order`: building the model with main or including the interaction effects; 1: only main effects (default), 2: both main and two-way interaction effects
- `delta_type`: type of effect size
- `delta`: effect size
- `alpha`: significance level
- `beta`: power
delta_type | type of standardized effect size; 1: standard deviation type (default), 2: range of effect type
delta | lists of effects size; The first and the second column is effect size of main and two-way interaction effects, respectively. The third and the forth column is standard deviation of whole noise and noise, respectively.
alpha | Type I error; 0.05 (default)
beta | Type II error; 0.20 (default)

Details

The linear model for the split-plot design is

$$y_{ijklm} = \mu + \tau_i + \beta_j + \gamma_k + (\beta \tau)_{ik} + \theta_{ijk} + \delta_l + \lambda_m + (\delta \lambda)_{lm} + (\beta \delta)_{jl} + (\beta \lambda)_{jm} + (\gamma \delta)_{kl} + (\delta \lambda)_{lm} + \epsilon_{ijklm}$$

where $\tau_i$ represents the replicate effect, $\beta_j, \gamma_k$ represents the whole plot main effects, $\theta_{ijk}$ is the whole plot error, $\delta_l, \lambda_m$ represent the subplot main effects, and $\epsilon_{ijklm}$ is the subplot error.

Value

model, optimal sample size and detectable standardized effect sizes

References


Examples

```R
# only main effects
A <- Size.Split(whole.factor=2, whole.factor.lev=c(2,2),
                split.factor=2, split.factor.lev=c(2,2), order=1,
                delta_type=1, delta=c(1,0,1,1), alpha=0.05, beta=0.2)
A$model
A$n
A$Delta

# including two-way interaction effects
B <- Size.Split(whole.factor=2, whole.factor.lev=c(2,2),
                split.factor=2, split.factor.lev=c(2,2), order=2,
                delta_type=1, delta=c(1,1,1,1), alpha=0.05, beta=0.2)
```

```
sizelist

Building the model

Description

Model is built on the number of factor and order.

Usage

sizelist(factor,order)

Arguments

<table>
<thead>
<tr>
<th>factor</th>
<th>the number of factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>order</td>
<td>building the model with main or including the interaction effects; 1: only main effects (default), 2: both main and two-way interaction effects</td>
</tr>
</tbody>
</table>

Value

terms and expansion of model

Examples

# 2 factors; both main and two-way interaction effects
A<-sizelist(2,2)
A$full_list
A$list1

sizelist.split

Building the model for split-plot design

Description

Model is built on the number of factor and order.

Usage

sizelist.split(whole.factor,split.factor,order)

Arguments

<table>
<thead>
<tr>
<th>whole.factor</th>
<th>the number of whole factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>split.factor</td>
<td>the number of split factor</td>
</tr>
<tr>
<td>order</td>
<td>building the model with main or including the interaction effects; 1: only main effects (default), 2: both main and two-way interaction effects</td>
</tr>
</tbody>
</table>
Value

terms and expansion of model

Examples

# one whole.factor and one split.factor; both main and two-way interaction effects
A<-sizelist.split(1,1,2)
A$full_list
A$list1
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