easyanova-package

Analysis of Variance and Other Important Complementary Analyzes

Description

Perform analysis of variance and other important complementary analyzes. The functions are easy
to use. Performs analysis in various designs, with balanced and unbalanced data.

Details

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Author(s)

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References

CRUZ, C.D. and CARNEIRO, P.C.S. Modelos biometricos aplicados ao melhoramento genctico.

KAPS, M. and LAMBERSON, W. R. Biostatistics for Animal Science: an introductory text. 2nd

SAMPAIO, I. B. M. Estatistica aplicada a experimentacao animal. 3nd Edition. Belo Horizonte:
264p.

SANDERS W.L. and GAYNOR, PJ. Analysis of switchback data using Statistical Analysis System,


See Also
e1, e2, ec

Examples

# Kaps and Lamberson(2009)
data(data1)
data(data2)
data(data3)
data(data4)

# analysis in completely randomized design
r1<-e1(data1, design=1)

names(r1)

r1

# analysis in randomized block design
r2<-e1(data2, design=2)

# analysis in latin square design
r3<-e1(data3, design=3)

# analysis in several latin squares design
r4<-e1(data4, design=4)

r1[1]
r2[1]
r3[1]
r4[1]

# analysis in unbalanced randomized block design
response<-ifelse(data2$Gain>850, NA, data2$Gain)
ndata<-data.frame(data2[-3],response)
ndata

r5<-e1(ndata, design=2 )

r5

# multivariable response (list argument = TRUE)
t<-c('a','a','a','b','b','b','c','c','c')
r1<-c(10,12,12.8,4,6,8,14,15,16)
```r
data1 <- c(102, 105, 106, 125, 123, 124, 99, 95, 96)

r2 <- c(560, 589, 590, 658, 678, 629, 369, 389, 378)

d <- data.frame(t, r1, r2, r3)

results <- eal(d, design = 1, list = TRUE)

names(results)

results

results[1][[1]]

names(results[1][[1]])
```

---

**data1**

**data1: Kaps and Lamerson(2009): page 252**

---

**Description**

The experiment compared three diets for pigs in a completely randomized design.

**Usage**

```r
data(data1)
```

**Format**

A data frame with 15 observations on the following 2 variables.

- **Diet**: a factor with levels `d1 d2 d3`
- **Gain**: a numeric vector

**References**


**Examples**

```r
data(data1)
summary(data1)
```
Description

Completely randomized design with a covariate. The effect of three diets on daily gain of steers was investigated. The design was a completely randomized design. Weight at the beginning of the experiment (initial weight) was recorded, but not used in the assignment of animals to diet.

Usage

data(data10)

Format

A data frame with 15 observations on the following 4 variables.

- **Diets**: a factor with levels A B C
- **Initial_weight**: a numeric vector
- **Repetitions**: a numeric vector
- **Gain**: a numeric vector

References


Examples

data(data10)
summary(data10)

---

Description

Incomplete block design

Usage

data(data11)
data12

Format
A data frame with 56 observations on the following 4 variables.
treatments  a numeric vector
rep  a numeric vector
blocks  a numeric vector
yield  a numeric vector

References

Examples
data(data11)
summary(data11)

---

Description
Incomplete block design

Usage
data(data12)

Format
A data frame with 42 observations on the following 4 variables.
treatments  a numeric vector
rep  a numeric vector
blocks  a numeric vector
yield  a numeric vector

References

Examples
data(data12)
summary(data12)
data13

**Description**
Incomplete block design

**Usage**
```
data(data13)
```

**Format**
A data frame with 23 observations on the following 3 variables.

- **genotypes** a factor with levels f1 f10 f11 f12 f13 f14 f2 f3 f4 f5 f6 f7 f8 f9 test1 test2 test3
- **blocks** a factor with levels b1 b2 b3
- **yield** a numeric vector

**References**

**Examples**
```
data(data13)
summary(data13)
```

data14

**Description**
Incomplete block design in animals

**Usage**
```
data(data14)
```
**Format**

A data frame with 28 observations on the following 4 variables.

- **treatment**: a factor with levels A B C D E F G
- **animal**: a factor with levels A1 A2 A3 A4 A5 A6 A7
- **period**: a factor with levels P1 P2 P3 P4
- **response**: a numeric vector

**References**


**Examples**

```r
data(data14)
summary(data14)
```

---

<table>
<thead>
<tr>
<th>data15</th>
<th>data15: Pimentel Gomes and Garcia (2002): page 211</th>
</tr>
</thead>
</table>

**Description**

Lattice design

**Usage**

```r
data(data15)
```

**Format**

A data frame with 48 observations on the following 4 variables.

- **treatments**: a numeric vector
- **rep**: a numeric vector
- **blocks**: a numeric vector
- **yield**: a numeric vector

**References**


**Examples**

```r
data(data15)
summary(data15)
```
Description
Switchback design

Usage
data(data16)

Format
A data frame with 36 observations on the following 4 variables.
treatment  a factor with levels A B C
period  a numeric vector
animal  a numeric vector
gain  a numeric vector

References

Examples
data(data16)
summary(data16)

data17

Description
Switchback design

Usage
data(data17)
data18

Format

A data frame with 36 observations on the following 5 variables.

treatments a numeric vector
blocks a factor with levels b1 b2 b3
period a numeric vector
animal a numeric vector
gain a numeric vector

References


Examples

data(data17)
summary(data17)

data18: Ramalho et al. (2005): page 115

Description

Repetition of experiments in block design

Usage

data(data18)

Format

A data frame with 60 observations on the following 4 variables.

treatments a numeric vector
experiments a numeric vector
blocks a numeric vector
response a numeric vector

References


Examples

data(data18)
summary(data18)
**data19**

**Description**

Repetition of latin square design

**Usage**

```r
data(data19)
```

**Format**

A data frame with 32 observations on the following 5 variables.

- `treatments` a factor with levels A B C D
- `squares` a factor with levels 1 2
- `rows` a factor with levels 1 2 3 4
- `columns` a factor with levels 1 2 3 4
- `response` a numeric vector

**References**


**Examples**

```r
data(data19)
summary(data19)
```

---

**data2**

**Description**

Complete randomized block design to determine the average daily gain of steers

**Usage**

```r
data(data2)
```
Format

A data frame with 12 observations on the following 3 variables.

- **Treatments** a factor with levels t1 t2 t3
- **Blocks** a factor with levels b1 b2 b3 b4
- **Gain** a numeric vector

References


Examples

```r
data(data2)
summary(data2)
```

---

**data3**

data3: Kaps and Lamberson (2009): page 347

Description

Latin square design for test four different treatments on hay intake of fattening steers

Usage

```r
data(data3)
```

Format

A data frame with 16 observations on the following 4 variables.

- **treatment** a factor with levels A B C D
- **period** a factor with levels p1 p2 p3 p4
- **steer** a factor with levels a1 a2 a3 a4
- **response** a numeric vector

References


Examples

```r
data(data3)
summary(data3)
```
**data4**

**data4: Kaps and Lamberson (2009): page 349**

---

**Description**

Two latin squares design for test four different treatments on hay intake of fattening steers

**Usage**

`data(data4)`

**Format**

A data frame with 32 observations on the following 5 variables.

- `diet` a factor with levels A B C D
- `square` a numeric vector
- `steer` a numeric vector
- `period` a numeric vector
- `response` a numeric vector

**References**


**Examples**

`data(data4)`

`summary(data4)`

---

**data5**

**data5: Kaps and Lamberson (2009): page 361**

---

**Description**

Factorial in randomized design for testing two vitamins in feed of pigs

**Usage**

`data(data5)`
data6

Format
A data frame with 20 observations on the following 3 variables.

Vitamin_1  a numeric vector
Vitamin_2  a numeric vector
Gains  a numeric vector

References

Examples
data(data5)
summary(data5)


Description
Factorial in randomized block design

Usage
data(data6)

Format
A data frame with 16 observations on the following 4 variables.

factor1  a numeric vector
factor2  a numeric vector
block  a numeric vector
yield  a numeric vector

References

Examples
data(data6)
summary(data6)
**data7**

**Description**

The aim of this experiment was to test the difference between two treatments on gain of kids. A sample of 18 kids was chosen, nine for each treatment. One kid in treatment 1 was removed from the experiment due to illness. The experiment began at the age of 8 weeks. Weekly gain was measured at ages 9, 10, 11 and 12 weeks.

**Usage**

```r
data(data7)
```

**Format**

A data frame with 68 observations on the following 4 variables.

- `treatment` a character vector
- `rep` a numeric vector
- `week` a character vector
- `gain` a numeric vector

**References**


**Examples**

```r
data(data7)
summary(data7)
```

**data8**

**Description**

Split-plot Design. Main Plots in Randomized Blocks. An experiment was conducted in order to investigate four different treatments of pasture and two mineral supplements on milk yield. The total number of cows available was 24. The experiment was designed as a split-plot, with pasture treatments (factor A) assigned to the main plots and mineral supplements (factor B) assigned to split-plots. The experiment was replicated in three blocks.
Usage
data(data8)

Format
A data frame with 24 observations on the following 4 variables.
pasture  a factor with levels p1 p2 p3 p4
block    a numeric vector
mineral  a factor with levels m1 m2
milk     a numeric vector

References

Examples
data(data8)
summary(data8)

---

Description
Factorial design to evaluate egg quality according to the lineage of chicken, packaging and storage time.

Usage
data(data9)

Format
A data frame with 120 observations on the following 5 variables.
lineage  a factor with levels A B
packing  a factor with levels Ce Co S
time     a numeric vector
repetitions a numeric vector
response a numeric vector
References


Examples

data(data9)
summary(data9)

---

e1

Analysis of variance in simple designs

Description

Perform analysis of variance and other important complementary analyzes. The function are easy to use. Performs analysis in various simples designs, with balanced and unbalanced data. Too performs analysis the kruskal-Wallis and Friedman (designs 14 and 15).

Usage

e1(data, design = 1, alpha = 0.05, list = FALSE, p.adjust=1, plot=2)

Arguments

data data is a data.frame

see how the input data in the examples
design 1 = completely randomized design
2 = randomized block design
3 = latin square design
4 = several latin squares
5 = analysis with a covariate (completely randomized design)
6 = analysis with a covariate (randomized block design)
7 = incomplete blocks type I and II
8 = incomplete blocks type III or augmented blocks
9 = incomplete blocks type III in animal experiments
10 = lattice (intra-block analysis)
11 = lattice (inter-block analysis)
12 = switchback design
13 = switchback design in blocks
14 = Kruskal-Wallis rank sum test
15 = Friedman rank sum test

alpha significance level for multiple comparisons
list
FALSE = a single response variable
TRUE = multivariable response

p.adjust
  1="none";  2="holm";  3="hochberg";  4="hommel";  5="bonferroni";  6="BH",
  7="BY";  8="fdr";  for more details see function "p.adjust"

plot
  1 = box plot for residuals;  2 = standardized residuals vs sequence data;  3 =
  standardized residuals vs theoretical quantiles

Details
The response variable must be numeric. Other variables can be numeric or factors.

Value
Returns analysis of variance, means (adjusted means), multiple comparison test (tukey, snk, duncan, t and scott knott) and residual analysis. Too returns analysis the kruskal-Wallis and Friedman (designs 14 and 15).

Author(s)
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References


See Also
ea2, ec

Examples

# Kaps and Lamberson(2009)
data(data1)
data(data2)
data(data3)
data(data4)
# analysis in completely randomized design
r1<-ea1(data1, design=1)

names(r1)

r1

# analysis in randomized block design
r2<-ea1(data2, design=2)

# analysis in latin square design
r3<-ea1(data3, design=3)

# analysis in several latin squares design
r4<-ea1(data4, design=4)

r1[1]
r2[1]
r3[1]
r4[1]

# analysis in unbalanced randomized block design
response<-ifelse(data2$Gain>850, NA, data2$Gain)
ndata<-data.frame(data2[-3],response)
ndata
r5<-ea1(ndata, design=2)

r5

# multivariable response (list argument = TRUE)
t<-c('a','a','a','b','b','b','c','c','c')
r1<-c(10,12,12.8,4,6,8,14,15,16)
r2<-c(102,105,106,125,123,124,99,95,96)
r3<-c(560,589,590,658,678,629,369,389,378)

d<-data.frame(t,r1,r2,r3)
results=ea1(d, design=1, list=TRUE)
names(results)
results
results[1][[1]]

names(results[1][[1]])

# analysis with a covariate
# Kaps and Lamberson (2009)
# data(data10)

# analysis in completely randomized design
# r6<-ea1(data10[-3], design=5)
# r6

# incomplete blocks type I and II
# Pimentel Gomes and Garcia (2002)
# data(data11)
# data(data12)

#r7<-ea1(data11,design=7)
#r8<-ea1(data12,design=7)
#r7;r8

# incomplete blocks type III or augmented blocks
# Cruz and Carneiro (2006)
# data(data13)

#r9<-ea1(data13, design=8)
#r9

# incomplete blocks type III in animal experiments
# Sampaio (2010)
# data(data14)

# r10<-ea1(data14, design=9)
# r10

# lattice
# Pimentel Gomes and Garcia (2002)
# data(data15)

#r11<-ea1(data15, design=10) # intra-block analysis
#r12<-ea1(data15, design=11) # inter-block analysis

#r11
#r12

# switchback design
# Sampaio (2010)
# data(data16)
# r13<-ea1(data16, design=12)
# r13

# switchback design in blocks
# Sanders and Gaynor (1987)
# data(data17)
# r14<-ea1(data17, design=13)
# r14
# Kruskal-Wallis Rank Sum Test
r15<-ea1(data1, design=14)

# Friedman Rank Sum Test
r16<-ea1(data2, design=15)

**ea2**

*Analysis of variance in factorial and split plot*

**Description**

Perform analysis of variance and other important complementary analyzes in factorial and split plot scheme, with balanced and unbalanced data.

**Usage**

ea2(data, design = 1, alpha = 0.05, cov = 4, list = FALSE, p.adjust=1, plot=2)

**Arguments**

- **data**: data is a data.frame
  - see how the input data in the examples
- **design**: 1 = double factorial in completely randomized design
  - 2 = double factorial in randomized block design
  - 3 = double factorial in latin square design
  - 4 = split plot in completely randomized design
  - 5 = split plot in randomized block design
  - 6 = split plot in latin square design
  - 7 = triple factorial in completely randomized design
  - 8 = triple factorial in randomized block design
  - 9 = double factorial in split plot (completely randomized)
  - 10 = double factorial in split plot (randomized in block)
  - 11 = joint analysis of experiments with hierarchical blocks
  - 12 = joint analysis of repetitions of latin squares (hierarchical rows)
  - 13 = joint analysis of repetitions of latin squares (hierarchical rows and columns)
- **alpha**: significance level for multiple comparisons
- **cov**: for split plot designs
  - 1 = Autoregressive
  - 2 = Heterogenius Autoregressive
  - 3 = Continuous Autoregressive Process
  - 4 = Compound Symetry
  - 5 = Unstructured
list  FALSE = a single response variable
     TRUE = multivariable response

p.adjust  1="none"; 2="holm"; 3="hochberg"; 4="hommel"; 5="bonferroni"; 6="BH", 7="BY"; 8="fdr"; for more details see function "p.adjust"

plot  1 = box plot for residuals; 2 = standardized residuals vs sequence data; 3 = standardized residuals vs theoretical quantiles

Details
The response variable must be numeric. Other variables can be numeric or factors.

Value
Returns analysis of variance, means (adjusted means), multiple comparison test (tukey, snk, duncan, t and scott knott) and residual analysis.

Author(s)
Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

References

See Also
ea1, ec

Examples

# double factorial
# completely randomized design
data(data5)
r1=ea2(data5, design=1)
r1

# randomized block design
# data(data6)
# r2=ea2(data6, design=2)
# r2

# names(r1)
# names(r2)

# triple factorial
# completely randomized design
# data(data9)
# r3=ea2(data9[-4], design=7)
# r3[1]

# split plot
# completely randomized design
# data(data7)
# r4=ea2(data7, design=4)
# r4

# randomized block design
# data(data8)
# r5=ea2(data8, design=5)
# r5

# hierarchical blocks
# Ramalho et al. (2005)
# data(data18)
# data18
# r6=ea2(data18, design=11)
# r6

# hierarchical latin squares
# Sampaio (2010)
# data(data19)
# data19
# r7=ea2(data19, design=12)
# r8=ea2(data19, design=13)

# hierarchical rows
# r7

# hierarchical rows and columns
# r8
Description
Perform contrasts of means

Usage
ec(mg1, mg2, sdg1, sdg2, df)

Arguments
- mg1: Means of the group 1
- mg2: Means of the group 2
- sdg1: Standard error of the group 1
- sdg2: Standard error of the group 2
- df: Degree of freedom from error

Value
Returns t test for contrast

Author(s)
Emmanuel Arnhold <emmanuelarnhold@yahoo.com.br>

References

See Also
ea1, ea2

Examples
# Kaps and Lamberson(2009, pg 254)
data(data1)
r<-ea1(data1, design=1)
r[2]

# first contrast
mg1=312; mg2=c(278,280); sdg1=7.7028; sdg2=c(7.7028,7.7028); df=12
ec(mg1,mg2,sdg1,sdg2,df)

# second contrast
mg1=280; mg2=278; sdg1=7.7028; sdg2=7.7028; df=12
ec(mg1,mg2,sdg1,sdg2,df)
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