Package ‘agricolae’

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Type Package
Title Statistical Procedures for Agricultural Research
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Imports klaR, MASS, nlme, cluster, AlgDesign, graphics
Description Original idea was presented in the thesis "A statistical analysis tool for agricultural research" to obtain the degree of Master on science, National Engineering University (UNI), Lima-Peru. Some experimental data for the examples come from the CIP and others research. Agricolae offers extensive functionality on experimental design especially for agricultural and plant breeding experiments, which can also be useful for other purposes. It supports planning of lattice, Alpha, Cyclic, Complete Block, Latin Square, Graeco-Latin Squares, augmented block, factorial, split and strip plot designs. There are also various analysis facilities for experimental data, e.g. treatment comparison procedures and several non-parametric tests comparison, biodiversity indexes and consensus cluster.
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Description

This package contains functionality for the Statistical Analysis of experimental designs applied specially for field experiments in agriculture and plant breeding.

Details

Package: agricolae
Type: Package
Version: 1.3-6
Date: 2023-06-30
License: GPL

Planning of field experiments: lattice, factorial, RCBD, CRD, Latin Square, Youden, Graeco, BIB, Alpha design, Cyclic, augmented block, split and strip plot Designs. Comparison of multi-location trials: AMMI, Index AMMI Stability (biplot, triplot), comparison between treatments: LSD, Bonferroni and other p-adjust, HSD, Waller, Student Newman Keuls SNK, Duncan, REGW, Scheffe; Non parametric tests: Kruskal, Friedman, Durbin, Van Der Waerden, Median. Analysis of genetic experiments: North Carolina designs, LinexTester, Balanced Incomplete Block, Strip plot, SplitPlot, Partially Balanced Incomplete Block, analysis Mother and baby trials (see data RioChillon). Resampling and simulation: resampling.model, simulation.model, montecarlo, lateblight Simulator

Author(s)

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References


Universidad Nacional Agraria La Molina, Lima-PERU. Facultad de Economia y Planificacion Departamento Academico de Estadistica e Informatica

AMMI AMMI Analysis

Description

Additive Main Effects and Multiplicative Interaction Models (AMMI) are widely used to analyze main effects and genotype by environment (GEN, ENV) interactions in multilocation variety trials. Furthermore, this function generates data to biplot, triplot graphs and analysis.

Usage

AMMI(ENV, GEN, REP, Y, MSE = 0, console=FALSE, PC=FALSE)

Arguments

ENV Environment
GEN Genotype
REP Replication
Y Response
MSE Mean Square Error
console output TRUE or FALSE
PC Principal components output TRUE or FALSE

Details

additional graphics see help(plot.AMMI).
Value

- **ANOVA**: analysis of variance general
- **genXenv**: class by, genopyte and environment analysis
- **means**: analysis of variance principal components
- **biplot**: average genotype and environment
- **PC**: data to produce graphics
- **class princomp**

Author(s)

F. de Mendiburu

References


See Also

- `lineXtester`, `plot.AMMI`

Examples

```r
# Full replications
library(agricolae)
# Example 1
data(plrv)
model<- with(plrv,AMMI(Locality, Genotype, Rep, Yield, console=FALSE))
model$ANOVA
# see help(plot.AMMI)
# biplot
plot(model)
# triplot PC 1,2,3
plot(model, type=2, number=TRUE)
# biplot PC1 vs Yield
plot(model, first=0,second=1, number=TRUE)
# Example 2
data(CIC)
data1<-CIC$comas[,c(1,6,7,17,18)]
data2<-CIC$oxapampa[,c(1,6,7,19,20)]
cic <- rbind(data1,data2)
model<-with(cic,AMMI(Locality, Genotype, Rep, relative))
model$ANOVA
plot(model,0,1,angle=20,ecol="brown")
# Example 3
# Only means. Mean square error is well-known.
data(sinRepAmmi)
REP <- 3
MSError <- 93.24224
#startgraph
model<-with(sinRepAmmi,AMMI(ENV, GEN, REP, YLD, MSError,PC=TRUE))
```
```r
# print anova
print(model$ANOVA, na.print = "")
# Biplot with the one restored observed.
plot(model, 0, 1, type = 1)
# with principal components model$PC is class "princomp"
pc <- model$PC
pc$loadings
summary(pc)
biplot(pc)
# Principal components by means of the covariance similar AMMI
# It is to compare results with AMMI
cova <- cov(model$genXenv)
values <- eigen(cova)
total <- sum(values$values)
round(values$values * 100 / total, 2)
# AMMI: 64.81 18.58 13.50 3.11 0.00
```

---

**AMMI.contour**  
**AMMI contour**

**Description**  
Draws a polygon or a circumference around the center of the Biplot with a proportional radio at the longest distance of the genotype.

**Usage**  
`AMMI.contour(model, distance, shape, ...)`

**Arguments**  
- `model` Object
- `distance` Circumference radius >0 and <=1
- `shape` Numerical, relating to the shape of the polygon outline.
- `...` Parameters corresponding to the R lines function

**Details**  
First, it is necessary to execute the AMMI function. It is only valid for the BIPLT function but not for the TRIPLT one.

**Value**  
Genotypes within and outside the area.

- `distance` Distance from genotype to origin (0,0)
audpc

Calculating the absolute or relative value of the AUDPC

description

Area Under Disease Progress Curve. The AUDPC measures the disease throughout a period. The AUDPC is the area that is determined by the sum of trapezes under the curve.

Usage

audpc(evaluation, dates, type = "absolute")

Arguments

evaluation Table of data of the evaluations: Data frame
dates Vector of dates corresponding to each evaluation
type relative, absolute

Details

AUDPC. For the illustration one considers three evaluations (14, 21 and 28 days) and percentage of damage in the plant 40, 80 and 90 (interval between dates of evaluation 7 days). AUDPC = 1045. The evaluations can be at different interval.
Value

Vector with relative or absolute audpc.

Author(s)

Felipe de Mendiburu

References


Examples

```r
library(agricolae)
dates<-c(14,21,28) # days
# example 1: evaluation - vector
evaluation<-c(40,80,90)
audpc(evaluation,dates)
# example 2: evaluation: dataframe nrow=1
evaluation<-data.frame(E1=40,E2=80,E3=90) # percentages
plot(dates,evaluation,type="h",ylim=c(0,100),col="red",axes=FALSE)
title(cex.main=0.8,main="Absolute or Relative AUDPC\nTotal area = 100*(28-14)=1400")
lines(dates,evaluation,col="red")
text(dates,evaluation+5,evaluation)
text(18,20,"A = (21-14)*(80+40)/2")
text(25,60,"B = (28-21)*(90+80)/2")
text(25,40,"audpc = A+B = 1015")
text(24.5,33,"relative = audpc/area = 0.725")
abline(h=0)
axis(1,dates)
axis(2,seq(0,100,5),las=2)
lines(rbind(c(14,40),c(14,100)),lty=8,col="green")
lines(rbind(c(14,100),c(28,100)),lty=8,col="green")
lines(rbind(c(28,90),c(28,100)),lty=8,col="green")
# It calculates audpc absolute
absolute<-audpc(evaluation,dates,type="absolute")
print(absolute)
rm(evaluation, dates, absolute)
# example 3: evaluation dataframe nrow>1
data(disease)
dates<-c(1,2,3) # week
evaluation<-disease[,c(4,5,6)]
# It calculates audpc relative
index <-audpc(evaluation, dates, type = "relative")
# Correlation between the yield and audpc
correlation(disease$yield, index, method="kendall")
# example 4: days infile
data(CIC)
comas <- CIC$comas
oxapampa <- CIC$oxapampa
dcomas <- names(comas)[9:16]
```
days <- as.numeric(substr(dcomas, 2, 3))
AUDPC <- audpc(comas[, 9:16], days)
relative <- audpc(comas[, 9:16], days, type = "relative")

h1 <- graph.freq(AUDPC, border = "red", density = 4, col = "blue")
table.freq(h1)

h2 <- graph.freq(relative, border = "red", density = 4, col = "blue",
frequency = 2, ylab = "relative frequency")

---

**audps**

*The Area Under the Disease Progress Stairs*

**Description**

A better estimate of disease progress is the area under the disease progress stairs (AUDPS). The AUDPS approach improves the estimation of disease progress by giving a weight closer to optimal to the first and last observations.

**Usage**

```r
audps(evaluation, dates, type = "absolute")
```

**Arguments**

- `evaluation`: Table of data of the evaluations: Data frame
- `dates`: Vector of dates corresponding to each evaluation
- `type`: relative, absolute

**Details**

AUDPS. For the illustration one considers three evaluations (14, 21 and 28 days) and percentage of damage in the plant 40, 80 and 90 (interval between dates of evaluation 7 days). AUDPS = 1470. The evaluations can be at different interval. AUDPS = sum( rectangle area by interval in times evaluation ) see example.

**Value**

Vector with relative or absolute audps.

**Author(s)**

Felipe de Mendiburu

**References**

Examples

```r
library(agricolae)
dates<-c(14,21,28) # days
# example 1: evaluation - vector
evaluation<-c(40,80,90)
audps(evaluation,dates)
audps(evaluation,dates,"relative")
x<-seq(10.5,31.5,7)
y<-c(40,80,90,90)
plot(x,y,"s",ylim=c(0,100),xlim=c(10,32),axes=FALSE,col="red" ,ylab="",xlab="")
title(cex.main=0.8,main="Absolute or Relative AUDPS\nTotal area=(31.5-10.5)*100=2100", ylab="evaluation",xlab="dates ")
points(x,y,type="h")
z<-c(14,21,28)
points(z,y[-3],col="blue",lty=2,pch=19)
points(z,y[-3],col="blue",lty=2,pch=19)
axis(1,x,pos=0)
axis(2,c(0,40,80,90,100),las=2)
text(dates,evaluation+5,dates,col="blue")
text(14,20,"A = (17.5-10.5)*40",cex=0.8)
text(21,40,"B = (24.5-17.5)*80",cex=0.8)
text(28,60,"C = (31.5-24.5)*90",cex=0.8)
text(14,95,"audps = A+B+C = 1470")
# It calculates audpc absolute
absolute<-audps(evaluation,dates,type="absolute")
print(absolute)
rm(evaluation, dates, absolute)
```

---

**bar.err**

**Plotting the standard error or standard deviance of a multiple comparison of means**

**Description**

It plots bars of the averages of treatments and standard error or standard deviance. It uses the objects generated by a procedure of comparison like LSD, HSD, Kruskal and Waller-Duncan.

**Usage**

```r
bar.err(x, variation=c("SE","SD","range","IQR"), horiz=FALSE, bar=TRUE,...)
```

**Arguments**

- `x` object means of the comparisons the LSD.test, HSD.test,...,etc
- `variation` SE=standard error, range=Max-Min or IQR=interquartil range
- `horiz` Horizontal or vertical bars
- `bar` paint bar
- `...` Parameters of the function barplot()
Details

x: data frame formed by 5 columns: name of the bars, height, level out: LSD.test, HSD, waller.test, scheffe.test, duncan.test, SNK.test, friedman, kruskal, waerden.test and Median.test.

Value

A list with numeric vectors giving the coordinates of all the bar midpoints drawn.

x eje-1 coordinate
height eje-2 coordinate by group

Author(s)

Felipe de Mendiburu

See Also

LSD.test, HSD.test, waller.test, kruskal, bar.group

Examples

library(agricolae)
data(sweetpotato)
model<-aov(yield~virus,data=sweetpotato)
out <- waller.test(model,"virus", console=TRUE,
main="Yield of sweetpotato\ndealt with different virus")
oldpar<-par(mfrow=c(2,2),cex=1)
bar.err(out$means,variation="range",horiz=TRUE,xlim=c(0,45),angle=125,density=6,
main="range")
bar.err(out$means,variation="SD",ylim=c(0,45),col=colors()[30],
main="Standard deviation",density=8)
bar.err(out$means,variation="SE",horiz=TRUE,xlim=c(0,45),density=8,
col="brown",main="Standard error")
bar.err(out$means,variation="range",ylim=c(0,45),bar=FALSE,col="green",
main="range")
par(oldpar)
oldpar<-par(mfrow=c(1,2),cex=1)
bar.err(out$means,variation="range",ylim=c(0,45),bar=FALSE,col=0)
abline(h=0)
# horiz = TRUE
bar.err(out$means,variation="SE",horiz=TRUE,xlim=c(0,45),bar=FALSE,col=0)
# startgraph
par(oldpar)
# endgraph
bar.group

Plotting the multiple comparison of means

Description

It plots bars of the averages of treatments to compare. It uses the objects generated by a procedure of comparison like LSD, HSD, Kruskall, Waller-Duncan, Friedman or Durbin. It can also display the ‘average’ value over each bar in a bar chart.

Usage

bar.group(x, horiz=FALSE, decreasing=TRUE, ...)

Arguments

x Object created by a test of comparison
horiz Horizontal or vertical bars
decreasing Logical, decreasing order of the mean
... Parameters of the function barplot()

Details

x: data frame formed by 5 columns: name of the bars, height and level of the bar.

Value

A list with numeric vectors giving the coordinates of all the bar midpoints drawn.

x eje-1 coordinate
height eje-2 coordinate by group

Author(s)

Felipe de Meniburu

See Also

LSD.test, HSD.test, kruskal, friedman, durbin.test, waller.test, plot.group

Examples

# Example 1
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus, data=sweetpotato)
comparison<- LSD.test(model, "virus", alpha=0.01, group=TRUE)
print(comparison$groups)
oldpar<-par(cex=1.5)
Finding the Variance Analysis of the Balanced Incomplete Block Design

Description

Analysis of variance BIB and comparison mean adjusted.

Usage

```r
BIB.test(block, trt, y, test = c("lsd","tukey","duncan","waller","snk"), alpha = 0.05, group = TRUE, console=FALSE)
```

Arguments

- `block`: blocks
- `trt`: Treatment
- `y`: Response
- `test`: Comparison treatments
- `alpha`: Significant test
- `group`: logical
- `console`: logical, print output

Details

Test of comparison treatment. lsd: Least significant difference. tukey: Honestly significant differente. duncan: Duncan's new multiple range test waller: Waller-Duncan test. snk: Student-Newman-Keuls (SNK)
Value

parameters  Design parameters
statistics  Statistics of the model
comparison  Comparison between treatments
means  Adjusted mean and statistics summary
groups  Grouping of treatments

Author(s)

F. de Mendiburu

References

Linear Estimation and Design of Experiments. D.D. Joshi. WILEY EASTERN LIMITED 1987, New Delhi, India.

See Also

DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples

library(agricolae)
run<-gl(10,3)
psi<-c(250,325,475,250,475,550,325,400,550,400,475,550,325,475,550,
250,400,475,250,325,400,250,400,550,250,325,525,325,400,475,250,
30,24,10,50,24,31,37)
monovinyl<-c(16,18,32,19,46,45,26,39,61,21,35,55,19,47,48,20,33,31,13,13,34,21,
30,24,10,50,24,31,37)
out<-BIB.test(run,psi,monovinyl,test="waller",group=FALSE)
print(out)
bar.err(out$means,variation="range",ylim=c(0,60),bar=FALSE,col=0)
out<-BIB.test(run,psi,monovinyl,test="waller",group=TRUE)
out<-BIB.test(run,psi,monovinyl,test="tukey",group=TRUE,console=TRUE)
out<-BIB.test(run,psi,monovinyl,test="tukey",group=FALSE,console=TRUE)
rm(run,psi,monovinyl,out)
# Example linear estimation and design of experiments. D.D. Joshi. 1987
# Professor of Statistics, Institute of Social Sciences Agra, India
# 6 varieties of wheat crop in a BIB whit 10 blocks of 3 plots each.
y <-c(69,77,72,63,70,54,65,65,57,59,50,45,68,75,59,38,60,60,62,
55,54,65,62,65,61,39,54,67,63,56)
varieties<-gl(6,5)
block <- c(1,2,3,4,5,1,2,6,7,8,1,3,6,9,10,2,4,7,9,10,3,5,7,8,9,4,5,6,8,10)
BIB.test(block, varieties, y)
# Example Introduction to experimental statistics. Ching Chun Li. 1964
# pag. 395 table. 27.2
# 7 trt, k=3 and b=7.
y <-c(10,15,11,4,12,15,5,14,10,14,19,19,8,10,17,6,11,12,5,14,21)
block<-gl(7,3)
trt <- c(1,2,4,2,3,5,3,4,6,4,5,7,1,5,6,2,6,7,1,3,7)
out<-BIB.test(block, trt, y, test="duncan")
bar.group(out$groups,col="blue",density=4,ylim=c(0,max(y)))
rm(y,block,trt,out)

carolina

North Carolina Designs I, II and III

Description
Statistic analysis of the Carolina I, II and III genetic designs.

Usage
carolina(model,data)

Arguments
model Constant

data Data frame

Details
model = 1,2 and 3 is I, II and III see carolina1,2 and 3.

Value
model model analysis (I, II or III) of carolina design
and variance and additive variance of male, female and male.female interaction.

Author(s)
Felipe de Mendiburu

References
Biometrical Methods in Quantitative Genetic Analysis, Singh, Chaudhary. 1979

See Also
DC
Examples

```r
library(agricolae)
data(DC)
carolina1 <- DC$carolina1
# str(carolina1)
output<-carolina(model=1,carolina1)
output[][-1]

carolina2 <- DC$carolina2
# str(carolina2)
majes<-subset(carolina2,carolina2[,1]==1)
majes<-majes[,c(2,5,4,3,6:8)]
output<-carolina(model=2,majes[,c(1:4,6)])
output[][-1]

carolina3 <- DC$carolina3
# str(carolina3)
output<-carolina(model=3,carolina3)
output[][-1]
```

---

**Chz2006**

*Data amendment Carhuaz 2006*

**Description**

Incidents and performance of healthy tubers and rotten potato field infested with naturally Ralstonia solanacearum Race 3/Bv 2A, after application of inorganic amendments and a rotation crop in Carhuaz Peru, 2006.

**Usage**

`data(Chz2006)`

**Format**

The format is: List of 2

- `amendment` a factor
- `crop` a factor
- `block` a numeric vector, replications
- `plant` a numeric vector, number plant
- `wilt_percent` a numeric vector, wilt percentage at 60 days
- `health` a numeric vector, kg/8m2
- `rot` a numeric vector, kg/8m2
Details

Application of inorganic amendment and crop rotation to control bacterial wilt of the potato (MBP).

Source

Experimental field, 2006. Data kindly provided by Pedro Aley.

References

International Potato Center. CIP - Lima Peru.

Examples

```r
library(agricolae)
data(Chz2006)
str(Chz2006)

wilt<-Chz2006$wilt
yield<-Chz2006$yield

means <- tapply.stat(wilt[5],wilt[,1:3],function(x) mean(x,na.rm=TRUE))
names(means)[4]<-"wilt_percent"

model <- aov(wilt_percent ~ block + crop, means)
anova(model)
cv.model(model)

yield<-yield[order(paste(yield[,1],yield[,2],yield[,3])),]

correlation(means[,4],yield[,4],method="spearman")
```

Data for late blight of potatoes

Description

A study of Phytophthora infestans in the potato plant in the localities of Comas and Oxapampa in Peru, 2005.

Usage

data(CIC)

Format

The format is: List of 2 (comas, oxapampa)

- **Locality**: a factor with levels Comas Oxapampa
- **Genotype**: a factor
- **Rep**: a numeric vector, replications
- **E9**: a numeric vector, infestans percentage to 9 days
- **AUDPC**: a numeric vector: the area under the disease-progress curve
- **Relative**: a numeric vector, relative area
Details

comas: temperature=59.9 Fahrenheit, relative humidity=83.3 oxapampa: temperature=64.8 Fahrenheit, relative humidity=86.2 AUDPC and relative see function audpc(). help(audpc) Exx: Evaluation in percentaje, xx is days. ORD1, ORD2, SBLK and row are references location of the plot in the field.

Source


References

International Potato Center. CIP - Lima Peru.

Examples

library(agricolae)
data(CIC)
CIC$comas
CIC$oxapampa

clay Data of Ralstonia population in clay soil

Description

An evaluation over a time period.

Usage

data(clay)

Format

A data frame with 69 observations on the following 3 variables.

per.clay a numeric vector
days a numeric vector
ralstonia a numeric vector

Source

Experimental field.

References

International Potato Center. CIP - Lima Peru.
Examples

library(agricolae)
data(clay)
str(clay)

ComasOxapampa

Data AUDPC Comas - Oxapampa

Description

Fifty-three potato varieties developed by the breeding program of the International Potato Center and released in different countries around the world were evaluated for their resistance to late blight in two locations in Peru.

Usage

data(ComasOxapampa)

Format

A data frame with 168 observations on the following 4 variables.

- cultivar a factor with 56 levels
- replication a factor with 3 levels
- comas a numeric vector
- oxapampa a numeric vector

Details

The experimental design was a randomized complete block design with 3 replications of 15 apical stem cuttings in Oxapampa and 10 tubers in Mariscal Castilla. Plots were 11.9 x 18.5 m in size with 30 cm in-row and 0.9 m between-row spacings. Spreader rows around plots were used at each site. Mancozeb was applied weekly until 30 days after transplanting or planting, after which the plants were left to natural infection. Due to climatic conditions not conducive to the disease in Oxapampa, inoculum was enhanced with local isolate (POX 067, with virulence R1, 2, 3, 4, 5, 6, 7, 10, 11) at a concentration of 5000-sporangia/ml at 49 days after planting. Percentage of foliar infection was estimated visually every 3 days for 8 times in Oxapampa and every 7 days for 12 times in Comas, then values were converted to the relative area under the diseases progress curve (rAUPDC). rAUDPC rankings were analyzed for phenotypic stability with nonparametric measures.

Source


References

International Potato Center. CIP - Lima Peru.
library(agricolae)

data(ComasOxapampa)

# Oxapampa (10 35 31 S latitude, 75 23 0 E longitude, 1813 m.a.s.l )
# Comas, Mariscal Castilla (11 42 54 S latitude, 75 04 45 E longitude, 2800 m.a.s.l,)

# cultivars LBr-40 (resistant), Cruza 148 (moderately resistant) and Pimpernell (susceptible)

str(ComasOxapampa)

means <- tapply.stat(ComasOxapampa[,3:4],ComasOxapampa$cultivar,mean)
correlation(means$comas,means$oxapampa, method="kendall")

consensus(ComasOxapampa)

consensus of clusters

Description

The criterion of the consensus is to produce many trees by means of bootstrap and to such calculate
the relative frequency with members of the clusters.

Usage

consensus(data,distance=c("binary","euclidean","maximum","manhattan",
"canberra","minkowski","gower","chisq"),method=c("complete","ward","single","average",
"mcquitty","median","centroid"),nboot=500,duplicate=TRUE,cex.text=1,
col.text="red", ...)

Arguments

data data frame
distance method distance, see dist()
method method cluster, see hclust()
nboot The number of bootstrap samples desired.
duplicate control is TRUE other case is FALSE
cex.text size text on percentage consensus
col.text color text on percentage consensus
...
parameters of the plot dendrogram

Details

distance: "euclidean", "maximum", "manhattan", "canberra", "binary", "minkowski", "gower",
"chisq". Method: "ward", "single", "complete", "average", "mcquitty", "median", "centroid". see
functions: dist(), hclust() and daisy() of cluster.

Value

table.dend The groups and consensus percentage
dendrogram The class object is hclust, dendrogram plot
duplicate Homonymous elements
Author(s)

F. de Mendiburu

References


See Also

hclust, hgroups, hcut

Examples

library(agricolae)
data(pamCIP)
# only codeownames(pamCIP)<-substr(rownames(pamCIP),1,6)
output<-consensus( pamCIP,distance="binary", method="complete",nboot=5)
# Order consensus
Groups<-output$table.dend[,c(6,5)]
Groups<-Groups[order(Groups[,2],decreasing=TRUE),]
print(Groups)
## Identification of the codes with the numbers.
cbind(output$dendrogram$labels)
## To reproduce dendrogram
dend<-output$dendrogram
data<-output$table.dend
plot(dend)
text(data[,3],data[,4],data[,5])
## Other examples
# classical dendrogram
dend<-as.dendrogram(output$dendrogram)
plot(dend,type="r",edgePar = list(lty=1:2, col=2:1))
text(data[,3],data[,4],data[,5],col="blue",cex=1)
plot(dend,type="t",edgePar = list(lty=1:2, col=2:1))
text(data[,3],data[,4],data[,5],col="blue",cex=1)
## Without the control of duplicates
output<-consensus( pamCIP,duplicate=FALSE,nboot=5)
## using distance gower, require cluster package.
# output<-consensus( pamCIP,distance="gower", method="complete",nboot=5)

---

corn

Data of corn
Description
Data from a completely randomized design where four different methods of growing corn resulted in various yields per acre on various plots of ground where the four methods were tried. Ordinarily, only one statistical analysis is used, but here we will use the kuskal-wallis test so that a rough comparison may be made with the mediasn test.

Usage
data(corn)

Format
A data frame with 34 observations on the following 3 variables.
method a numeric vector
observation a numeric vector
rx a numeric vector

Details
The observations are ranked from the smallest, 77, of rank 1 to the largest 101, of rank N=34. Ties values receive the average rank.

Source
Book: Practical Nonparametric Statistics.

References

Examples
data(corn)
str(corn)

---
correl Correlation Coefficient

Description
An exact correlation for ties or without ties. Methods of Kendall, Spearman and Pearson.

Usage
correl(x, y, method = "pearson", alternative="two.sided")
correlation

Arguments

x Vector
y Vector
method "pearson", "kendall", "spearman"
alternative "two.sided", "less", "greater"

Value

The correlation of x,y vector with the statistical value and its probability

Author(s)

Felipe de Mendiburu

References


See Also

correlation

Examples

library(agricolae)
data(soil)
with(soil,correl(pH,clay,method="kendall"))
with(soil,correl(pH,clay,method="spearman"))
with(soil,correl(pH,clay,method="pearson"))

correlation  Correlation analysis. Methods of Pearson, Spearman, Kendall and Lin

Description

It obtains the coefficients of correlation and p-value between all the variables of a data table. The methods to apply are Pearson, Spearman, Kendall and lin’s concordance index. In case of not specifying the method, the Pearson method will be used. The results are similar to SAS.

Usage

correlation(x,y=NULL, method = c("pearson", "kendall", "spearman", "lin"), alternative="two.sided")
correlation

Arguments

x  table, matrix or vector
y  table, matrix or vector
method  "pearson", "kendall", "spearman", "lin"
alternative  "two.sided", "less", "greater"

Details

Parameters equal to function cor()

Value

The correlation matrix with its probability

Author(s)

Felipe de Mendiburu

References


See Also

correl

Examples

library(agricolae)
data(soil)
# example 1
analysis<-correlation(soil[,2:8],method="pearson")
analysis
# Example 2: correlation between pH, variable 2 and other elements from soil.
analysis<-with(soil,correlation(pH,soil[,3:8],method="pearson",alternative="less"))
analysis
# Example 3: correlation between pH and clay method kendall.
with(soil,correlation(pH,clay,method="kendall", alternative="two.sided"))
cotton

Data of cotton

Description

Data of cotton collected in experiments of two localities in Lima and Pisco, Peru.

Usage

data(cotton)

Format

A data frame with 96 observations on the following 5 variables.

site a factor with levels Lima Pisco
block a factor with levels I II III IV V VI
lineage a numeric vector
epoca a numeric vector
yield a numeric vector

Source

Book spanish: Metodos estadisticos para la investigacion. Autor: Calzada Benza Universidad Nacio-
nal Agraria - La Molina - Peru..

References

Book spanish: Metodos estadisticos para la investigacion. Autor: Calzada Benza Universidad Na-
nional Agraria - La Molina - Peru.

Examples

library(agricolae)
data(cotton)
str(cotton)
cv.model

Coefficient of the experiment variation

Description

It obtains the coefficient of variation of the experiment obtained by models lm() or aov()

Usage

cv.model(x)

Arguments

x object of model lm() or AOV()

Details

sqrt(MSerror)*100/mean(x)

Value

Returns the coefficient of variation of the experiment according to the applied statistical model

Author(s)

Felipe de Mendiburu

See Also

LSD.test, HSD.test, waller.test

Examples

# see examples from LSD, Waller-Duncan or HSD and complete with it:
library(agricolae)
# not run
# cv<-cv.model(model)
cv.similarity  

**Coefficient of the similarity matrix variation**

**Description**

This process consists of finding the coefficient of the distances of similarity of binary tables (1 and 0) as used for scoring molecular marker data for presence and absence of PCR amplification products.

**Usage**

```r
cv.similarity(A)
```

**Arguments**

- `A`  
  matrix of binary data

**Value**

Returns the coefficient of variation of the similarity model

**Author(s)**

Felipe de Mendiburu

**See Also**

- `similarity`
- `resampling.cv`

**Examples**

```r
# molecular markers.
library(agricolae)
data(markers)
cv<-cv.similarity(markers)
```
Finding the Variance Analysis of the Augmented block Design

Description
Analysis of variance Augmented block and comparison mean adjusted.

Usage
DAU.test(block, trt, y, method = c("lsd","tukey"), alpha=0.05, group=TRUE, console=FALSE)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>block</td>
<td>blocks</td>
</tr>
<tr>
<td>trt</td>
<td>Treatment</td>
</tr>
<tr>
<td>y</td>
<td>Response</td>
</tr>
<tr>
<td>method</td>
<td>Comparison treatments</td>
</tr>
<tr>
<td>alpha</td>
<td>Significant test</td>
</tr>
<tr>
<td>group</td>
<td>TRUE or FALSE</td>
</tr>
<tr>
<td>console</td>
<td>logical, print output</td>
</tr>
</tbody>
</table>

Details
Method of comparison treatment. lsd: Least significant difference. tukey: Honestly significant differente. The controls can have different repetitions, at least two, do not use missing data.

Value

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>means</td>
<td>Statistical summary of the study variable</td>
</tr>
<tr>
<td>parameters</td>
<td>Design parameters</td>
</tr>
<tr>
<td>statistics</td>
<td>Statistics of the model</td>
</tr>
<tr>
<td>comparison</td>
<td>Comparison between treatments</td>
</tr>
<tr>
<td>groups</td>
<td>Formation of treatment groups</td>
</tr>
<tr>
<td>SE.difference</td>
<td>Standard error of:</td>
</tr>
<tr>
<td></td>
<td>Two Control Treatments</td>
</tr>
<tr>
<td></td>
<td>Two Augmented Treatments</td>
</tr>
<tr>
<td></td>
<td>Two Augmented Treatments(Different Blocks)</td>
</tr>
<tr>
<td></td>
<td>A Augmented Treatment and A Control Treatment</td>
</tr>
<tr>
<td>vartau</td>
<td>Variance-covariance matrix of the difference in treatments</td>
</tr>
</tbody>
</table>

Author(s)
F. de Mendiburu
References


See Also

BIB.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples

library(agricolae)
block<-c(rep("I",7),rep("II",6),rep("III",7))
trt<-c("A","B","C","D","g","k","l","A","B","C","D","e","l","A","B","C","D","f","h","j")
yield<-c(83,77,78,78,70,75,74,79,81,81,91,79,78,92,79,87,81,89,96,82)
out<- DAU.test(block,trt,yield,method="lsd", group=TRUE)
print(out$groups)
plot(out)

DC

Data for the analysis of carolina genetic design

Description

Data for the analysis of carolina I, II and III genetic design

Usage

data(DC)

Details

DC is list, 3 data.frame: carolina1(72 obs, 6 var), carolina2(300 obs, 9 var) and carolina3(64 obs, 5 var).

Carolina1: Data for the analysis of Carolina I Genetic design. In this design F2 or any advanced generation maintained by random mating, produced from cross between two pure-lines, is taken as base population. From the population an individual is randomly selected and used as a male. A set of 4 randomly selected plans are used as females and are mated to the above male. Thus a set of 4 full-sib families are produced. This is denoted as a male group. Similarly, a large number of male groups are produced. No female is used for any second mating. four male groups (16 female groups) from a set.

Carolina2: Data for the analysis of Carolina II Genetic design. Both paternal and maternal half-sibs are produced in this design. From an F2 population, n1 males and n2 females are randomly selected and each male is crossed to each of the females. Thus n1 x n2 progenies are produced whicht are analysed in a suitably laid experiment.

Carolina3: Data for the analysis of Carolina III genetic design. The F2 population is produced by crossing two inbreds, say L1 and L2. The material for estimation of genetic parameters is produced
by back crossing randomly selected F2 individuals (using as males) to each of the inbreds (used as females).

**Source**


**References**


**Examples**

```r
data(DC)
names(DC)
str(DC$carolina1)
str(DC$carolina2)
str(DC$carolina3)
```

---

**delete.na**

Omitting the rows or columns with missing observations of a matrix (NA)

---

**Description**

In many situations it is required to omit the rows or columns less or greater with NA of the matrix.

**Usage**

```r
delete.na(x, alternative=c("less", "greater") )
```

**Arguments**

- `x` matrix with NA
- `alternative` "less" or "greater"

**Value**

- `x` matrix

**Author(s)**

Felipe de Mendiburu
Examples

```r
library(agricolae)
x<-c(2,5,3,7,5,NA,8,0,4,3,NA,NA)
dim(x)<-c(4,3)
x
# [,1] [,2] [,3]
#[1,]  2  5  4
#[2,]  5  NA  3
#[3,]  3  8  NA
#[4,]  7  0  NA

delete.na(x,"less")
# [,1]
#[1,]  2
#[2,]  5
#[3,]  3
#[4,]  7

delete.na(x,"greater")
# [,1] [,2] [,3]
#[1,]  2  5  4
```

design.ab

---

**Description**

It generates a design of blocks, randomize and latin square for combined n. factors uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

**Usage**

```r
design.ab(trt, r, serie = 2, design=c("rcbd","crd","lsd"),
seed = 0, kinds = "Super-Duper",first=TRUE,randomization=TRUE)
```

**Arguments**

- **trt**: n levels factors
- **r**: Replications or Blocks
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **design**: type
- **seed**: Seed
- **kinds**: Method for to randomize
- **first**: TRUE or FALSE - randomize rep 1
- **randomization**: TRUE or FALSE - randomize
Details


Value

parameters      Design parameters
book            Fieldbook

Author(s)

Felipe de Mendiburu

References


See Also

design.split, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip

Examples

# factorial 3 x 2 with 3 blocks
library(agricolae)
trt<-c(3,2) # factorial 3x2
outdesign <-design.ab(trt, r=3, serie=2)
book<-outdesign$book
head(book,10) # print of the field book
# factorial 2 x 2 x 2 with 5 replications in completely randomized design.
trt<-c(2,2,2)
outdesign<-design.ab(trt, r=5, serie=2,design="crd")
book<-outdesign$book
print(book)
# factorial 3 x 3 in latin square design.
trt <-c(3,3)
outdesign<-design.ab(trt, serie=2, design="lsd")
book<-outdesign$book
print(book)
**design.alpha**  
*Alpha design type (0,1)*

**Description**

Generates an alpha designs starting from the alpha design fixing under the series formulated by Patterson and Williams. These designs are generated by the alpha arrangements. They are similar to the lattice designs, but the tables are rectangular s by k (with s blocks and k< s columns. The number of treatments should be equal to s*k and all the experimental units r*s*k (r replications).

**Usage**

```r
design.alpha(trt, k, r, serie = 2, seed = 0, kinds = "Super-Duper", randomization=TRUE)
```

**Arguments**

- `trt` Treatments
- `k` size block
- `r` Replications
- `serie` number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- `seed` seed
- `kinds` method for to randomize
- `randomization` TRUE or FALSE - randomize

**Details**

Parameters for the alpha design: I. r=2, k <= s; II. r=3, s odd, k <= s; III.r=3, s even, k <= s-1; IV. r=4, s odd but not a multiple of 3, k<=s

**Value**

- `parameters` Design parameters
- `statistics` Design statistics
- `sketch` Design sketch
- `book` Fieldbook

**Author(s)**

Felipe de Mendiburu

**References**

design.bib

See Also
design.ab, design.split, design.bib, design.crd, design.cyclic, design.dau, design.graeco,
design.lattice, design.lsd, design.rcbd, design.strip

Examples

library(agricolae)
#Example one
trt<-1:30
t <- length(trt)
# size block k
k<-3
# Blocks s
s<-t/k
# replications r
r <- 2
outdesign<-- design.alpha(trt,k,r,serie=2)
book<--outdesign$book
plots<--book[,1]
dim(plots)<-c(k,s,r)
for (i in 1:r) print(t(plots[,,i]))
outdesign$sketch

# Example two
trt<-letters[1:12]
t <- length(trt)

k<-3
r<-3
s<-t/k
outdesign<-- design.alpha(trt,k,r,serie=2)
book<--outdesign$book
plots<--book[,1]
dim(plots)<-c(k,s,r)
for (i in 1:r) print(t(plots[,,i]))
outdesign$sketch

---

**design.bib**  
*Randomized Balanced Incomplete Block Designs. BIB*

**Description**

Creates Randomized Balanced Incomplete Block Design. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

**Usage**

design.bib(trt, k, r=NULL, serie = 2, seed = 0, kinds = "Super-Duper", maxRep=20, randomization=TRUE)
Arguments
\begin{itemize}
  \item \texttt{trt} \hspace{1em} Treatments
  \item \texttt{k} \hspace{1em} size block
  \item \texttt{r} \hspace{1em} Replications
  \item \texttt{serie} \hspace{1em} number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
  \item \texttt{seed} \hspace{1em} seed
  \item \texttt{kinds} \hspace{1em} method for to randomize
  \item \texttt{maxRep} \hspace{1em} repetition maximum
  \item \texttt{randomization} \hspace{1em} TRUE or FALSE - randomize
\end{itemize}

Details

The package AlgDesign is necessary.

if \texttt{r = NULL}, then it calculates the value of \texttt{r} smaller for \texttt{k} defined. In the case of \texttt{r = value}, then the possible values for \texttt{r} is calculated

\texttt{K} is the smallest integer number of treatments and both values are consistent in design.


Value
\begin{itemize}
  \item \texttt{parameters} \hspace{1em} Design parameters
  \item \texttt{statistics} \hspace{1em} Design statistics
  \item \texttt{sketch} \hspace{1em} Design sketch
  \item \texttt{book} \hspace{1em} Fieldbook
\end{itemize}

Author(s)
Felipe de Mendiburu

References
\begin{enumerate}
  \item Optimal Experimental Design with R. Dieter Rasch, Jurgen Pilz, Rob Verdooren and Albrecht Gebhardt. 2011 by Taylor and Francis Group, LLC CRC Press is an imprint of Taylor and Francis Group, an Informa business.
\end{enumerate}

See Also
\texttt{design.ab, design.alpha, design.split, design.crd, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip}
Examples

```r
library(agricolae)
# 4 treatments and k=3 size block
trt<-c("A","B","C","D")
k<-3
outdesign<design.bib(trt,k,serie=2,seed =41,kinds ="Super-Duper") # seed = 41
print(outdesign$parameters)
book<outdesign$book
plots <-as.numeric(book[,1])
matrix(plots,byrow=TRUE,ncol=k)
print(outdesign$sketch)
# write in hard disk
# write.csv(book,"book.csv", row.names=FALSE)
# file.show("book.csv")
```

---

**design.crd**  
*Completely Randomized Design*

**Description**

It generates completely a randomized design with equal or different repetition. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

**Usage**

design.crd(trt, r, serie = 2, seed = 0, kinds = "Super-Duper",randomization=TRUE)

**Arguments**

- **trt**: Treatments
- **r**: Replications
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **seed**: seed
- **kinds**: method for to randomize
- **randomization**: TRUE or FALSE - randomize

**Details**


**Value**

- **parameters**: Design parameters
- **book**: Fieldbook
Author(s)

Felipe de Mendiburu

References


See Also

design.ab, design.alpha, design.bib, design.split, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip

Examples

library(agricolae)
trt <- c("CIP-101","CIP-201","CIP-301","CIP-401","CIP-501")
r <- c(4,3,5,4,3)
# seed = 12543
outdesign1 <- design.crd(trt, r, serie=2,2543,"Mersenne-Twister")
book1<-outdesign1
# no seed
outdesign2 <- design.crd(trt, r, serie=3)
print(outdesign2$parameters)
book2<-outdesign2
# write to hard disk
# write.table(book1,"crd.txt", row.names=FALSE, sep="\t")
# file.show("crd.txt")

---

design.cyclic  Cyclic designs

Description

The cyclic design is a incomplete blocks designs, it is generated from a incomplete block initial of the size k, the plan is generated and randomized. The efficient and robust cyclic designs for 6 to 30 treatments, replications \(\leq 10\).

Usage

design.cyclic(trt, k, r, serie = 2, rowcol = FALSE, seed = 0, kinds = "Super-Duper", randomization=TRUE)
**Arguments**

- **trt**: vector treatments
- **k**: block size
- **r**: Replications
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **rowcol**: TRUE: row-column design
- **seed**: init seed random
- **kinds**: random method
- **randomization**: TRUE or FALSE - randomize

**Details**

Number of treatments 6 to 30. (r) Replication 2 to 10. (k) size of block 2 to 10. replication = i*k, "i" is value integer.

**Value**

- **parameters**: Design parameters
- **sketch**: Design sketch
- **book**: Fieldbook

**Author(s)**

Felipe de Mendiburu

**References**


**See Also**

design.ab, design.alpha, design.bib, design.crd, design.split, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip

**Examples**

```r
library(agricolae)
trt<-letters[1:8]
# block size = 2, replication = 6
outdesign1 <- design.cyclic(trt,k=2, r=6,serie=2)
names(outdesign1)
# groups 1,2,3
outdesign1$sketch[[1]]
outdesign1$sketch[[2]]
outdesign1$sketch[[3]]
outdesign1$book
```
# row-column design

```r
outdesign2 <- design.cyclic(trt=2, r=6, serie=2, rowcol=TRUE)
outdesign2$sketch
```

---

**design.dau**  
*Augmented block design*

### Description

These are designs for two types of treatments: the control treatments (common) and the increased treatments. The common treatments are applied in complete randomized blocks, and the increased treatments, at random. Each treatment should be applied in any block once only. It is understood that the common treatments are of a greater interest; the standard error of the difference is much smaller than when between two increased ones in different blocks.

### Usage

```r
design.dau(trt1, trt2, r, serie = 2, seed = 0, kinds = "Super-Duper", name="trt", randomization=TRUE)
```

### Arguments

- `trt1`: checks
- `trt2`: new
- `r`: Replications or blocks
- `serie`: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- `seed`: seed
- `kinds`: method for to randomize
- `name`: name of treatments
- `randomization`: TRUE or FALSE - randomize

### Details

```r
```

### Value

- `parameters`: Design parameters
- `book`: Fieldbook

### Author(s)

Felipe de Mendiburu
design.graeco

References

See Also
design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.split, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip

Examples
library(agricolae)
# 4 treatments and 5 blocks
T1<-c("A","B","C","D")
T2<-letters[20:26]
outdesign <-design.dau(T1,T2, r=5,serie=2)
# field book
book<-outdesign$book
by(book,book[2],function(x) paste(x[,1],"-",as.character(x[3])))
# write in hard disk
# write.table(book,"dau.txt", row.names=FALSE, sep="\t")
# file.show("dau.txt")
# Augmented designs in Completely Randomized Design
trt<-c(T1,T2)
r<-c(4,4,4,1,1,1,1,1,1,1,1,1)
outdesign <- design.crd(trt,r)
outdesign$book

design.graeco

Graeco - latin square design

Description
A graeco - latin square is a KxK pattern that permits the study of k treatments simultaneously with three different blocking variables, each at k levels.
The function is only for squares of the odd numbers and even numbers (4, 8, 10 and 12)

Usage
design.graeco(trt1, trt2, serie = 2, seed = 0, kinds = "Super-Duper", randomization=TRUE)

Arguments

- **trt1**: Treatments
- **trt2**: Treatments
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
design.graeco

seed seed
kinds method for to randomize
randomization TRUE or FALSE - randomize

Details

Value
parameters Design parameters
book Fieldbook

Author(s)
Felipe de Mendiburu

References

See Also
design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.split,
design.lattice, design.lsd, design.rcbd, design.strip

Examples
library(agricolae)
T1<-c("a","b","c","d")
T2<-c("v","w","x","y")
outdesign <- design.graeco(T1,T2,serie=1)
graeco<-outdesign$book
plots <-as.numeric(graeco[,1])
print(outdesign$sketch)
print(matrix(plots,byrow=TRUE,nrow=4))
# 10 x 10
T1 <- letters[1:10]
T2 <- 1:10
outdesign <- design.graeco(T1,T2,serie=2)
print(outdesign$sketch)
**Design.lattice**

Lattice designs

**Description**

SIMPLE and TRIPLE lattice designs. It randomizes treatments in k x k lattice.

**Usage**

```r
design.lattice(trt, r=3, serie = 2, seed = 0, kinds = "Super-Duper",randomization=TRUE)
```

**Arguments**

- **trt**: treatments
- **r**: r=2(simple) or r=3(triple) lattice
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **seed**: seed
- **kinds**: method for to randomize
- **randomization**: TRUE or FALSE - randomize

**Details**

```r
```

**Value**

- **parameters**: Design parameters
- **statistics**: Design statistics
- **sketch**: Design sketch
- **book**: Fieldbook

**Author(s)**

Felipe de Mendiburu

**References**


**See Also**

design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.graeco, design.split, design.lsd, design.rcbd, design.strip
Examples

    library(agricolae)
    # triple lattice
    trt<-'LETTERS'[1:9]
    outdesign<-design.lattice(trt,r=3,serie=2) # triple lattice design (9 trt)
    # simple lattice
    trt<-1:100
    outdesign<-design.lattice(trt,r=2,serie=3) # simple lattice design, 10x10

---

**design.lsd**

*Latin Square Design*

Description

It generates Latin Square Design. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

Usage

```
design.lsd(trt, serie = 2, seed = 0, kinds = "Super-Duper", first=TRUE,randomization=TRUE)
```

Arguments

- **trt**: Treatments
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **seed**: seed
- **kinds**: method for to randomize
- **first**: TRUE or FALSE - randomize rep 1
- **randomization**: TRUE or FALSE - randomize

Details

```
```

Value

- **parameters**: Design parameters
- **book**: Fieldbook

Author(s)

Felipe de Mendiburu
design.mat

Experimental design matrix

Description
Generate the design matrix from the fieldbook generated by an experimental plan or a dataframe for analysis.

Usage
design.mat(book, locations)

Arguments

book  data frame or matrix, field book
locations  numeric, column position of the field book

Value
X is matrix design.

Author(s)
Felipe de Mendiburu
### design.rcbd

**Randomized Complete Block Design**

**Description**

It generates Randomized Complete Block Design. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

**Usage**

```r
design.rcbd(trt, r, serie = 2, seed = 0, kinds = "Super-Duper", first=TRUE, continue=FALSE, randomization=TRUE )
```

**Arguments**

- **trt**: Treatments
- **r**: Replications or blocks
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **seed**: seed
- **kinds**: method for to randomize
- **first**: TRUE or FALSE - randomize rep 1
- **continue**: TRUE or FALSE, continuous numbering of plot
- **randomization**: TRUE or FALSE - randomize

**Details**

```r
```
design.split

Value

<table>
<thead>
<tr>
<th>parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>parameters</td>
<td>Design parameters</td>
</tr>
<tr>
<td>sketch</td>
<td>Design sketch</td>
</tr>
<tr>
<td>book</td>
<td>Fieldbook</td>
</tr>
</tbody>
</table>

Author(s)

Felipe de Mendiburu

References


See Also

design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.split, design.strip

Examples

```r
library(agricolae)
# 5 treatments and 6 blocks
trt<-c("A","B","C","D","E")
outdesign <-design.rcbd(trt,6,serie=2,986,"Wichmann-Hill") # seed = 986
book <-outdesign$book # field book
# write in hard disk
# write.table(book,"rcbd.txt", row.names=FALSE, sep="\t")
# file.show("rcbd.txt")
# Plots in field model ZIGZAG
fieldbook <- zigzag(outdesign)
print(outdesign$sketch)
print(matrix(fieldbook[,1],byrow=TRUE,ncol=5))
# continuous numbering of plot
outdesign <-design.rcbd(trt,6,serie=0,continue=TRUE)
head(outdesign$book)
```

design.split  Split Plot Design

Description

It generates split plot design. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

Usage

design.split(trt1, trt2,r=NULL, design=c("rcbd","crd","lsd"),serie = 2, seed = 0, kinds = "Super-Duper", first=TRUE,randomization=TRUE)
Arguments

- *trt1*: Treatments in Plots
- *trt2*: Treatments in Subplots
- *r*: Replications or blocks
- *design*: Experimental design
- *serie*: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- *seed*: seed
- *kinds*: method for to randomize
- *first*: TRUE or FALSE - randomize rep 1
- *randomization*: TRUE or FALSE - randomize

Details


Value

- *parameters*: Design parameters
- *book*: Fieldbook

Author(s)

Felipe de Mendiburu

References


See Also

design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip

Examples

library(agricolae)
# 4 treatments and 5 blocks in split-plot
t1<-c("A", "B", "C", "D")
t2<-c(1,2,3)
outdesign <- design.split(t1, t2, r=3, serie=2, seed=45, kinds = "Super-Duper")#seed=45
book <- outdesign$book# field book
# write in hard disk
# write.table(book,"book.txt", row.names=FALSE, sep="\t")
# file.show("book.txt")
design.strip  

Strip Plot Design

Description

It generates strip plot design. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

Usage

design.strip(trt1, trt2, r, serie = 2, seed = 0, kinds = "Super-Duper", randomization=TRUE)

Arguments

- **trt1**: Row treatments
- **trt2**: column treatments
- **r**: Replications
- **serie**: number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- **seed**: seed
- **kinds**: method for to randomize
- **randomization**: TRUE or FALSE - randomize

Details


Value

- **parameters**: Design parameters
- **book**: Fieldbook

Author(s)

Felipe de Mendiburu

References


See Also

design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.split
Examples

```
library(agricolae)
# 4 and 3 treatments and 3 blocks in strip-plot
t1<-c("A","B","C","D")
t2<-c(1,2,3)
r<-3
outdesign <-design.strip(t1,t2,r , serie=2,seed=45,kinds ="Super-Duper") # seed = 45
book <-outdesign$book # field book
# write in hard disk
# write.table(book,"book.txt", row.names=FALSE, sep="\t")
# file.show("book.txt")
```

---

design.youden  
*Incomplete Latin Square Design*

Description

Such designs are referred to as Youden squares since they were introduced by Youden (1937) after Yates (1936) considered the special case of column equal to number treatment minus 1. "Random" uses the methods of number generation in R. The seed is by set.seed(seed, kinds).

Usage

```
design.youden(trt, r, serie = 2, seed = 0, kinds = "Super-Duper",first=TRUE ,randomization=TRUE)
```

Arguments

- `trt` Treatments
- `r` Replications or number of columns
- `serie` number plot, 1: 11,12; 2: 101,102; 3: 1001,1002
- `seed` seed
- `kinds` method for to randomize
- `first` TRUE or FALSE - randomize rep 1
- `randomization` TRUE or FALSE - randomize

Details

```
```

Value

- `parameters` Design parameters
- `sketch` Design sketch
- `book` Fieldbook
diffograph

Author(s)
Felipe de Mendiburu

References

See Also
design.ab, design.alpha, design.bib, design.crd, design.cyclic, design.dau, design.graeeco, design.lattice, design.split, design.rcbd, design.strip, design.lsd

Examples
library(agricolae)
varieties<-c("perricholi","yungay","maria bonita","tomasa")
r<-3
outdesign <-design.youden(varieties,r,serie=2,seed=23)
youden <- outdesign$book
print(outdesign$sketch)
plots <-as.numeric(youden[,1])
print(matrix(plots,byrow=TRUE,ncol=r))
print(youden) # field book.
# Write on hard disk.
# write.table(youden,"youden.txt", row.names=FALSE, sep="\t")
# file.show("youden.txt")

diffograph

Plotting the multiple comparison of means

Description
It plots bars of the averages of treatments to compare. It uses the objects generated by a procedure of comparison like LSD (Fisher), duncan, Tukey (HSD), Student Newman Keul (SNK), Scheffe, Ryan, Einot and Gabriel and Welsch (REGW), Kruskal Wallis, Friedman and Waerden.

Usage
diffograph(x, main=NULL,color1="red",color2="blue",color3="black", cex.axis=0.8,las=1,pch=20,bty="l",cex=0.8,lwd=1,xlab="",ylab="",...)

Arguments
x Object created by a test of comparison, group=FALSE
main The main title (on top)
color1 non significant color
color2  significant color
color3  center line color
cex.axis parameters of the plot()
las parameters of the plot()
pch parameters of the plot()
bty parameters of the plot()
cex parameters of the plot()
lwd parameters of the plot()
xlab parameters of the plot()
ylab parameters of the plot()
... Other parameters of the function plot()

Details

The graph.diff function should be used for functions: LSD, duncan, SNK, scheffe, REGW, HSD, kruskal, friedman and waerden test.

Value

x list, object comparison test

Author(s)

Felipe de Mendiburu

References


See Also

LSD.test, HSD.test, duncan.test, SNK.test, scheffe.test, REGW.test, kruskal, friedman, waerden.test

Examples

# Example 1
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus,data=sweetpotato)
x<- LSD.test(model,"virus",alpha=0.01,group=FALSE)
diffograph(x,cex.axis=0.8,xlab="Yield",ylab="")
# Example 2
x<- REGW.test(model,"virus",alpha=0.01,group=FALSE)
diffograph(x,cex.axis=0.6,xlab="Yield",ylab="",color1="brown",color2="green")
Data evaluation of the disease overtime

Description

Three evaluations over time and the potato yield when applying several treatments.

Usage

data(disease)

Format

A data frame with 21 observations on the following 7 variables.

- plots  a numeric vector
- rep    a numeric vector
- trt    a factor with levels T0 T1 T2 T3 T4 T5 T6
- E2     a numeric vector
- E5     a numeric vector
- E7     a numeric vector
- yield  a numeric vector

Source

Experimental data.

References

International Potato Center. CIP - Lima Peru.

Examples

library(agricolae)
data(disease)
str(disease)
duncan.test

**Description**

This test is adapted from the Newman-Keuls method. Duncan’s test does not control family wise error rate at the specified alpha level. It has more power than the other post tests, but only because it doesn’t control the error rate properly. The Experimentwise Error Rate at: 1-(1-alpha)^(a-1); where "a" is the number of means and is the Per-Comparison Error Rate. Duncan’s procedure is only very slightly more conservative than LSD. The level by alpha default is 0.05.

**Usage**

duncan.test(y, trt, DFerror, MSerror, alpha = 0.05, group=TRUE, main = NULL, console=FALSE)

**Arguments**

- **y**: model(aov or lm) or answer of the experimental unit
- **trt**: Constant( only y=model) or vector treatment applied to each experimental unit
- **DFerror**: Degree free
- **MSerror**: Mean Square Error
- **alpha**: Significant level
- **group**: TRUE or FALSE
- **main**: Title
- **console**: logical, print output

**Details**

It is necessary first makes a analysis of variance.

if y = model, then to apply the instruction:
duncan.test(model, "trt", alpha = 0.05, group = TRUE, main = NULL, console = FALSE)
where the model class is aov or lm.

**Value**

- **statistics**: Statistics of the model
- **parameters**: Design parameters
- **duncan**: Critical Range Table
- **means**: Statistical summary of the study variable
- **comparison**: Comparison between treatments
- **groups**: Formation of treatment groups
durbin.test

Author(s)
Felipe de Mendiburu

References

See Also
BIB.test, DAU.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus,data=sweetpotato)
out <- duncan.test(model,"virus",
main="Yield of sweetpotato. Dealt with different virus")
plot(out,variation="IQR")
duncan.test(model,"virus",alpha=0.01,console=TRUE)
# version old duncan.test()
df<-df.residual(model)
MSerror<--deviance(model)/df
out <- with(sweetpotato,duncan.test(yield,virus,df,MSerror, group=TRUE))
plot(out,horiz=TRUE,las=1)
print(out$groups)

durbin.test  Durbin test and multiple comparison of treatments

Description
A multiple comparison of the Durbin test for the balanced incomplete blocks for sensorial or categorical evaluation. It forms groups according to the demanded ones for level of significance (alpha); by default, 0.05.

Usage
durbin.test(judge, trt, evaluation, alpha = 0.05, group =TRUE,
main = NULL, console=FALSE)
Arguments

judge Identification of the judge in the evaluation
trt Treatments
evaluation variable
alpha level of significant
group TRUE or FALSE
main Title
console logical, print output

Details

The post hoc test is using the criterium Fisher’s least significant difference.

Value

statistics Statistics of the model
parameters Design parameters
means Statistical summary of the study variable
rank rank table of the study variable
comparison Comparison between treatments
groups Formation of treatment groups

Author(s)

Felipe de Mendiburu

References


See Also

BIB.test, DAU.test, duncan.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples

library(agricolae)
# Example 1. Conover, pag 391
person<-gl(7,3)
variety<-c(1,2,4,2,3,5,3,4,6,4,5,7,1,5,6,2,6,7,1,3,7)
preference<-c(2,3,1,3,1,2,2,1,3,1,2,3,3,1,2,3,1,2,3,1,2)
out<durbin.test(person,variety,preference,group=TRUE,console=TRUE,
main="Seven varieties of ice cream manufacturer")
#startgraph
bar.group(out$groups,horiz=TRUE,xlim=c(0,10),density=4,las=1)
Example 2. Myles Hollander, pag 311
Source: W. Moore and C.I. Bliss. 1942

day<-gl(7,3)
chemical<-c("A","B","D","A","C","E","C","D","G","A","F","G","B","C","F",
"B","E","G","D","E","F")
toxic<-c(0.465,0.343,0.396,0.602,0.873,0.634,0.875,0.325,0.330,0.423,0.987,
0.426,0.652,1.142,0.989,0.536,0.409,0.309,0.609,0.417,0.931)
out<-durbin.test(day,chemical,toxic,group=TRUE,console=TRUE,
main="Logarithm of Toxic Dosages")
plot(out)

friedman Friedman test and multiple comparison of treatments

Description
The data consist of b-blocks mutually independent k-variate random variables Xij, i=1...b; j=1...k. The random variable X is in block i and is associated with treatment j. It makes the multiple comparison of the Friedman test with or without ties. A first result is obtained by friedman.test of R.

Usage
friedman(judge,trt,evaluation,alpha=0.05,group=TRUE,main=NULL,console=FALSE)

Arguments
judge Identification of the judge in the evaluation
trt Treatment
evaluation Variable
alpha Significant test
group TRUE or FALSE
main Title
console logical, print output

Details
The post hoc friedman test is using the criterium Fisher’s least significant difference (LSD)

Value
statistics Statistics of the model
parameters Design parameters
means Statistical summary of the study variable
comparison Comparison between treatments
groups Formation of treatment groups
Author(s)
Felipe de Mendiburu

References
Practical Nonparametrics Statistics. W.J. Conover, 1999

See Also
BIB.test, DAU.test, duncan.test, durbin.test, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples
library(agricolae)
data(grass)
out<-with(grass,friedman(judge,trt, evaluation,alpha=0.05, group=TRUE,console=TRUE, main="Data of the book of Conover"))
#startgraph
plot(out,variation="IQR")
#endgraph

frijol Data of frijol

Description
Data of frijol under 4 technologies for the homogeneity of regression study. Yield of Frijol in kg/ha in clean and dry grain.
Technologies: 20-40-20 kg/ha. N. P2O5 and K2O + 2 t/ha of gallinaza. 40-80-40 kg/ha. N. P2O5 and K2O + 2 t/ha of gallinaza. 60-120-60 kg/ha. N. P2O5 and K2O + 2 t/ha of gallinaza. 40-80-40 kg/ha. N. P2O5 and K2O + 4 t/ha of gallinaza.

Usage
data(frijol)

Format
A data frame with 84 observations on the following 3 variables.
technology a factor with levels a b c d
production a numeric vector
index a numeric vector

References
Oriente antioqueno (1972) (ICA.- Orlando Martinez W.) Colombia.
Examples

```r
library(agricolae)
data(frijol)
str(frijol)
```

---

**genxenv**

*Data of potato yield in a different environment*

**Description**

50 genotypes and 5 environments.

**Usage**

```r
data(genxenv)
```

**Format**

A data frame with 250 observations on the following 3 variables.

- **ENV**: a numeric vector
- **GEN**: a numeric vector
- **YLD**: a numeric vector

**Source**

International Potato Center. CIP - Lima Peru.

**References**

International Potato Center. CIP - Lima Peru.

**Examples**

```r
library(agricolae)
data(genxenv)
str(genxenv)
```
Glycoalkaloids  Data Glycoalkaloids

**Description**

A measurement of the Glycoalkaloids by two methods: HPLC and spectrophotometer.

**Usage**

```r
data(Glycoalkaloids)
```

**Format**

A data frame with 25 observations on the following 2 variables.

- **HPLC**  a numeric vector
- **spectrophotometer**  a numeric vector

**Source**

International Potato Center. CIP - Lima Peru.

**References**

International Potato Center. CIP - Lima Peru.

**Examples**

```r
library(agricolae)
data(Glycoalkaloids)
str(Glycoalkaloids)
```

---

**graph.freq**  **Histogram**

**Description**

In many situations it has intervals of class defined with its respective frequencies. By means of this function, the graphic of frequency is obtained and it is possible to superpose the normal distribution, polygon of frequency, Ojiva and to construct the table of complete frequency.

**Usage**

```r
graph.freq(x, breaks=NULL,counts=NULL,frequency=1, plot=TRUE, nclass=NULL,
xlab="",ylab="",axes = "",las=1,...)
```
graph.freq

Arguments

x  a vector of values, a object hist(), graph.freq()
counts frequency and x is class intervals
breaks a vector giving the breakpoints between histogram cells
frequency 1=counts, 2=relative, 3=density
plot logic
nclass number of classes
xlab x labels
ylab y labels
las numeric in 0,1,2,3; the style of axis labels. see plot()
axes TRUE or FALSE
... other parameters of plot

Value

breaks a vector giving the breakpoints between histogram cells
counts frequency and x is class intervals
mids center point in class
relative Relative frequency, height
density Density frequency, height

Author(s)
Felipe de Mendiburu

See Also

polygon.freq, table.freq, stat.freq, inter.freq, sturges.freq, join.freq, ogive.freq, normal.freq

Examples

library(agricolae)
data(genxenv)
yield <- subset(genxenv$YLD,genxenv$ENV==2)
yield <- round(yield,1)
h<- graph.freq(yield,axes=FALSE, frequency=1, ylab="frequency",col="yellow")
axis(1,h$breaks)
axis(2,seq(0,20,0.1))
# To reproduce histogram.
h1 <- graph.freq(h, col="blue", frequency=2,border="red", density=8,axes=FALSE,
xlab="YIELD",ylab="relative")
axis(1,h$breaks)
axis(2,seq(0,.4,0.1))
# summary, only frecuency
limits <-seq(10,40,5)
frequencies <- c(2, 6, 8, 7, 3, 4)
# startgraph
h <- graph.freq(limits, counts = frequencies, col = "bisque", xlab = "Classes")
polygon.freq(h, col = "red")
title(main = "Histogram and polygon of frequency", ylab = "frequency")
# endgraph
# Statistics
measures <- stat.freq(h)
print(measures)
# frequency table full
round(table.freq(h), 2)
# startgraph
# ogive
ogive.freq(h, col = "red", type = "b", ylab = "Accumulated relative frequency", xlab = "Variable")
# only frequency polygon
h <- graph.freq(limits, counts = frequencies, border = FALSE, col = NULL, xlab = " ", ylab = "")
title(main = "Polygon of frequency", xlab = "Variable", ylab = "Frequency")
polygon.freq(h, col = "blue")
grid(col = "brown")
# endgraph
# Draw curve for Histogram
h <- graph.freq(yield, axes = FALSE, frequency = 3, ylab = "f(yield)", col = "yellow")
axis(1, h$breaks)
axis(2, seq(0, 0.18, 0.03), las = 2)
lines(density(yield), col = "red", lwd = 2)
title("Draw curve for Histogram")

---

Data for Friedman test

Description

Twelve homeowners are selected randomly to participate in an experiment with a plant nursery. Each homeowner is asked to select four fairly identical areas in his yard and to plant four different types of grasses, one in each area.

Usage

data(grass)

Format

A data frame with 48 observations on the following 3 variables.

judge  a numeric vector
trt   a factor with levels t1 t2 t3 t4
evaluation  a numeric vector
Details

Each of the 12 blocks consists of four fairly identical plots of land, each receiving care of approximately the same degree of skill because the four plots are presumably cared for by the same homeowner.

Source


References

Practical Nonparametrics Statistics. W.J. Conover, 1999

Examples

data(grass)
str(grass)

<table>
<thead>
<tr>
<th>greenhouse</th>
<th>Data in greenhouse</th>
</tr>
</thead>
</table>

Description

Potato minituber production in greenhouse, three sets of data in potato varieties with different methods: hydroponics, Aeroponic, Pots and Plant beds, the unit is in grams and the number of tubers in units,

Usage
data(greenhouse)

Details

greenhouse is list, three tables: greenhouse1(480 obs, 5 var), yield for plant, unit is grams. greenhouse2(48 obs, 5 var), Yields of 10 plants by experimental unit(grams). planting date(April 24, 2004) and harvest date(July 16, 2004) and greenhouse3(480 obs, 5 var), Tubers by plants.

Source

International Potato Center(CIP). Lima-Peru. Data Kindly provided by Carlos Chuquillanqui.

References

Examples

```r
library(agricolae)
data(greenhouse)
greenhouse1 <- greenhouse$greenhouse1
greenhouse2 <- greenhouse$greenhouse2
greenhouse3 <- greenhouse$greenhouse3
```

| growth | Data growth of trees |

Description
Data growth of pijuayo trees in several localities.

Usage
`data(growth)`

Format
A data frame with 30 observations on the following 3 variables.

- `place` a factor with levels L1 L2
- `slime` a numeric vector
- `height` a numeric vector

Source
Experimental data (Pucallpa - Peru)

References
ICRAF lima Peru.

Examples

```r
library(agricolae)
data(growth)
str(growth)
```
Data of AUDPC for nonparametrical stability analysis

Description

Published data. Haynes. Mean area under the disease progress curve (AUDPC) for each of 16 potato clones evaluated at eight sites across the United States in 1996

Usage

data(haynes)

Format

A data frame with 16 observations on the following 9 variables.

clone a factor with levels A84118-3 A080432-1 A084275-3 AWN86514-2 B0692-4 B0718-3 B0749-2F B0767-2 Bertita Bzura C0083008-1 Elba Greta Krantz Libertas Stobrawa FL a numeric vector MI a numeric vector ME a numeric vector MN a numeric vector ND a numeric vector NY a numeric vector PA a numeric vector WI a numeric vector

References


Examples

library(agricolae)
data(haynes)
str(haynes)
Description
Incidents and performance of healthy tubers and rotten potato field infested with naturally Ralstonia solanacearum Race 3/Bv 2A, after application of inorganic amendments and a rotation crop in Huanuco Peru, 2006.

Usage
data(Hco2006)

Format
The format is: List of 2
amendment a factor
crop a factor
block a numeric vector, replications
plant a numeric vector, number plant
wilt_percent a numeric vector, wilt percentage at 60 days
health a numeric vector, kg/8m2, 20 plants
rot a numeric vector, kg/8m2, 20 plants

Details
Application of inorganic amendment and crop rotation to control bacterial wilt of the potato (MBP).

Source
Experimental field, 2006. Data Kindly provided by Pedro Aley.

References
International Potato Center. CIP - Lima Peru.

Examples
library(agricolae)
data(Hco2006)
str(Hco2006)
wilt<-Hco2006$wilt
yield<-Hco2006$yield
means <- tapply.stat(wilt[,5],wilt[,1:3],function(x) mean(x,na.rm=TRUE))
names(means)[4]<-"wilt_percent"
model <- aov(wilt_percent ~ block + crop, means)


\begin{verbatim}
anova(model)
cv.model(model)
yield<-yield[order(paste(yield[,1],yield[,2],yield[,3])),]
correlation(means[,4],yield[,4],method="spearman")
\end{verbatim}

---

**Description**

It shows dendrogram of a consensus of a tree generated by hclust.

**Usage**

\begin{verbatim}
hcut(consensus,h,group,col.text="blue",cex.text=1,...)
\end{verbatim}

**Arguments**

- **consensus**: object consensus
- **h**: numeric scalar or vector with heights where the tree should be cut.
- **group**: an integer scalar with the desired number of group
- **col.text**: color of number consensus
- **cex.text**: size of number consensus
- **...**: Other parameters of the function plot() in cut()

**Value**

hcut Returns a data frame with group memberships and consensus tree.

**Author(s)**

F. de Mendiburu

**See Also**

hclust, consensus, hgroups

**Examples**

\begin{verbatim}
library(agricolae)
data(pamCIP)
# only code
rownames(pamCIP)<-substr(rownames(pamCIP),1,6)
# groups of clusters
# output<-consensus(pamCIP,nboot=100)
# hcut(output,h=0.4,group=5,main="Group 5")
#
# hcut(output,h=0.4,group=8,type="t",edgePar=list(lty=1:2,col=2:1),main="group 8"
# ,col.text="blue",cex.text=1)
\end{verbatim}
Data of potato, Heterosis

Description

Determination of heterosis, general combining ability (GCA) and specific combining ability in tuber dry matter, reducing sugars and agronomic characteristics in TPS families.

Usage

data(heterosis)

Format

A data frame with 216 observations on the following 11 variables.

Place 1: La Molina, 2=Huancayo
Replication a numeric vector
Treatment a numeric vector
Factor a factor with levels Control progenie progenitor testigo
Female a factor with levels Achirana LT-8 MF-I MF-II Serrana TPS-2 TPS-25 TPS-7
Male a factor with levels TPS-13 TPS-67 TS-15
v1 Yield (Kg/plant)
v2 Reducing sugars (scale):1 low and 5=High
v3 Tuber dry matter (percentage)
v4 Tuber number/plant
v5 Average tuber weight (g)

Details

The study was conducted in 3 environments, La Molina-PERU to 240 masl. during autumn-winter and spring, and in Huancayo-PERU 3180 masl., during summer. The experimental material consisted of 24 families half brother in the form of tubers derived from TPS, obtained crossing between 8 female and 3 male parents. Design used was randomized complete block with three repetitions. The experimental unit was 30 plants in two rows at a distance of 30cm between plants and 90 cm between rows. Variables evaluated were Yield, Tubers number, Dry matter and content and reducing sugars. The analysis was conducted line x tester. The control variety was Desiree.

Source

International Potato Center(CIP). Lima-Peru. Data Kindly provided by of Rolando Cabello.
hgroups

References


Examples

```r
library(agricolae)
data(heterosis)
str(heterosis)
site1<-subset(heterosis,heterosis[,1]==1)
site2<-subset(heterosis,heterosis[,1]==2)
site3<-subset(heterosis,heterosis[,1]==3)
model1<-with(site1,lineXtester(Replication, Female, Male, v1))
DFe <- df.residual(model1)
CMe <- deviance(model1)/DFe
test1 <- with(site1,HSD.test(v1, Factor,DFe,CMe))
test2 <- with(site1,HSD.test(v1, Treatment,DFe,CMe))
model22<-with(site2,lineXtester(Replication, Female, Male, v3))
model3<-with(site3,lineXtester(Replication, Female, Male, v4))
```

hgroups

Description

Returns a vector with group memberships. This function is used by the function consensus of clusters.

Usage

```r
hgroups(hmerge)
```

Arguments

- `hmerge`: The object is components of the hclust

Value

The merge clusters is printed.

Author(s)

F. de Mendiburu
See Also

hclust, hcut, consensus

Examples

library(agricolae)
data(pamCIP)
# only code
rownames(pamCIP) <- substr(rownames(pamCIP), 1, 6)
distance <- dist(pamCIP, method = "binary")
clusters <- hclust(distance, method = "complete")
# groups of clusters
hgroups(clusters$merge)

HSD.test

Multiple comparisons: Tukey

Description

It makes multiple comparisons of treatments by means of Tukey. The level by alpha default is 0.05.

Usage

HSD.test(y, trt, DError, MSError, alpha = 0.05, group = TRUE, main = NULL,
unbalanced = FALSE, console = FALSE)

Arguments

y model(aov or lm) or answer of the experimental unit
trt Constant (only y=model) or vector treatment applied to each experimental unit
DError Degree free
MSError Mean Square Error
alpha Significant level
group TRUE or FALSE
main Title
unbalanced TRUE or FALSE. not equal replication
console logical, print output

Details

It is necessary first makes a analysis of variance.

if y = model, then to apply the instruction:
HSD.test (model, "trt", alpha = 0.05, group = TRUE, main = NULL, unbalanced = FALSE, console = FALSE)
where the model class is aov or lm.
Value

- **statistics**: Statistics of the model
- **parameters**: Design parameters
- **means**: Statistical summary of the study variable
- **comparison**: Comparison between treatments
- **groups**: Formation of treatment groups

Author(s)

Felipe de Mendiburu

References


See Also

- BIB.test
- DAU.test
- duncan.test
- durbin.test
- friedman
- kruskal
- LSD.test
- Median.test
- PBIB.test
- REGW.test
- scheffe.test
- SNK.test
- waerden.test
- waller.test
- plot.group

Examples

```R
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus, data=sweetpotato)
out <- HSD.test(model,"virus", group=TRUE,console=TRUE,
main="Yield of sweetpotato\nDealt with different virus")
#stargraph
# Variation range: max and min
plot(out)
#endgraph
out<-HSD.test(model,"virus", group=FALSE)
print(out$comparison)
# Old version HSD.test()
df<-df.residual(model)
MSError<-deviance(model)/df
with(sweetpotato,HSD.test(yield,virus,df,MSError, group=TRUE,console=TRUE,
main="Yield of sweetpotato. Dealt with different virus"))
```
Description

Timing fungicide sprays based on accumulated rainfall thresholds can be a successful component of integrated management packages that include cultivars with moderate or high levels of resistance to late blight. The simplicity of measuring accumulated rainfall means that the technology can potentially be used by resource-poor farmers in developing countries.

Usage

data(huasahuasi)

Format

The format is: List of 2 (AUDPC, YIELD)

block a factor with levels I II III
trt a factor with levels 40mm 7-days Non-application
clon a factor with levels C386209.10 C387164.4 Cruza148 Musuq Yungay
y1da a numeric vector, Kgr./plot
y2da a numeric vector, Kgr./plot
y3ra a numeric vector, Kgr./plot
d44 a numeric vector, 44 days
d51 a numeric vector, 51 days
d100 a numeric vector, 100 days

Details

The experimental unit was formed by 4 furrows of 1.8 m of length, with distance between furrows from 0.90 m and between plants of 0.30 m. In each furrow was installed 5 plants. The experiment had 3 repetitions. From the beginning of the experiment were fulfilled the following treatments Thresholds 40 mm: Apply the fungicide when 40 precipitation mm accumulates. The minimum interval between applications will be of 7 days. Schedule 7 days: The applications should be carried out every 7 days calendar. Without application: No fungicide application will be made. The evaluation of the severity of the late blight in each treatment started to emergency 80 percentage and then evaluations were made every 7 days until being observed a physiological maturation of the crop.

Source

**index.AMMI**

### References

International Potato Center. CIP - Lima Peru.

### Examples

```r
library(agricolae)
data(huasahuasi)
names(huasahuasi)
str(huasahuasi$AUDPC)
str(huasahuasi$YIELD)
```

### Description

calculate AMMI stability value (ASV) and Yield stability index (YSI).

### Usage

```r
index.AMMI(model)
```

### Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>model</td>
<td>object AMMI</td>
</tr>
</tbody>
</table>

### Details

AMMI stability value (ASV) was calculated using the following formula, as suggested by Purchase (1997)

```r
ASV = \sqrt{SSpc1/SSpc2 * \text{PC1}^2 + (\text{PC2})^2}
```

`YSI = RASV + RY`

`YASV = \text{rank(ASV)}` and `RY = \text{rank(Y across by environment)}`

### Value

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASV</td>
<td>AMMI stability value</td>
</tr>
<tr>
<td>YSI</td>
<td>Yield stability index</td>
</tr>
<tr>
<td>rASV</td>
<td>Rank of AMMI stability value</td>
</tr>
<tr>
<td>rYSI</td>
<td>Rank of yield stability index</td>
</tr>
<tr>
<td>means</td>
<td>average genotype by environment</td>
</tr>
</tbody>
</table>

### Author(s)

F. de Mendiburu
References


Parametric analysis to describe genotype x environment interaction and yield stability in winter wheat. PURCHASE, J. L. (1997). Ph.D. Thesis, Department of Agronomy, Faculty of Agriculture of the University of the Free State, Bloemfontein, South Africa.

See Also

AMMI.plot.AMMI

Examples

library(agricolae)
# Index AMMI
data(plrv)
model<- with(plrv,AMMI(Locality, Genotype, Rep, Yield, console=FALSE))
Idx<- index.AMMI(model)
names(Idx)
# Crops with improved stability according AMMI.
print(Idx[order(Idx[,3]),])
# Crops with better response and improved stability according AMMI.
print(Idx[order(Idx[,4]),])

index.bio

Biodiversity Index

Description

Scientists use a formula called the biodiversity index to describe the amount of species diversity in a given area.

Usage


Arguments

data number of specimens
method Describe method bio-diversity
level Significant level
nboot size bootstrap
console output console TRUE
index.smith

Details

method bio-diversity. "Margalef" "Simpson Dom" "Simpson Div" "Berger Parker" "McIntosh" "Shannon"

Value

Index and confidence intervals.

Author(s)

Felipe de Mendiburu

References


Examples

library(agricolae)
data(paracsho)
# date 22-06-05 and treatment CON = application with insecticide
specimens <- paracsho[1:10,6]
output1 <- index.bio(specimens,method="Simpson.Div",level=95,nboot=100)
output2 <- index.bio(specimens,method="Shannon",level=95,nboot=100)
rbind(output1, output2)

index.smith

Uniformity soil. Smith’s Index of Soil Heterogeneity

Description

Smith’s index of soil heterogeneity is used primarily to derive optimum plot size. The index gives a single value as a quantitative measure of soil heterogeneity in an area. Graph CV for plot size and shape.

Usage

index.smith(data, PLOT=TRUE,...)

Arguments

data dataframe or matrix
PLOT graphics, TRUE or FALSE
... Parameters of the plot()
Details

\[ V_x = \frac{V(x)}{x} b \]

\( V(x) \) is the between-plot variance, \( V_x \) is the variance per unit area for plot size of \( x \) basic unit, and \( b \) is the Smith' index of soil heterogeneity.

Value

<table>
<thead>
<tr>
<th>model</th>
<th>function pattern of uniformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>uniformity</td>
<td>Table of the soil uniformity</td>
</tr>
</tbody>
</table>

Author(s)

Felipe de Mendiburu

References


Examples

```r
library(agricolae)
data(rice)
#startgraph
table<-index.smith(rice,
  main="Relationship between CV per unit area and plot size",col="red")
#endgraph
uniformity <- data.frame(table$uniformity)
# regression variance per unit area an plot size.
model <- lm(Vx ~ I(log(Size)),uniformity)
coeff <- coef(model)
x<-1:max(uniformity$Size)
Vx<- coeff[1]+coeff[2]*log(x)
#startgraph
plot(x,Vx, type="l", col="blue",
  main="Relationship between variance per unit area and plot size")
points(uniformity$Size,uniformity$Vx)
#endgraph
```

```
inter.freq  

Class intervals

Description

List class intervals.
**join.freq**

Usage

inter.freq(x)

Arguments

x class graph.freq, histogram or numeric

Value

It show interval classes.

Author(s)

Felipe de Mendiburu

See Also

polygon.freq, table.freq, stat.freq, graph.freq, sturges.freq, join.freq, ogive.freq, normal.freq

Examples

library(agricolae)
# example 1
data(growth)
h<-hist(growth$height,plot=FALSE)
ter.freq(h)
# example 2
x<-seq(10,40,5)
y<-c(2,6,8,7,3,4)
ter.freq(x)
histogram <- graph.freq(x,counts=y)

---

### Description

In many situations it is required to join classes because of the low frequency in the intervals. In this process, it is required to join the intervals and ad the frequencies of them.

Usage

join.freq(histogram, join)

Arguments

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>histogram</td>
<td>Class graph.freq</td>
</tr>
<tr>
<td>join</td>
<td>vector</td>
</tr>
</tbody>
</table>
Value

New histogram with union of classes.

Author(s)
Felipe de Mendiburu

See Also

polygon.freq, table.freq, stat.freq, inter.freq, sturges.freq, graph.freq, ogive.freq, normal.freq

Examples

library(agricolae)
data(natives)
# histogram
h1<-graph.freq(natives$size,plot=FALSE)
round(table.freq(h1),4)
# Join classes 9, 10,11 and 12 with little frequency.
h2<-join.freq(h1,9:12)
# new table
plot(h2,col="bisque",xlab="Size")
round(summary(h2),4)

kendall  Correlation of Kendall

Description

Correlation of Kendall two set. Compute exact p-value with ties.

Usage

kendall(data1, data2)

Arguments

data1  vector
data2  vector

Value

The correlation of data1, data2 vector with the statistical value and its probability

Author(s)
Felipe de Mendiburu
kruskal

References


See Also
correlation

Examples

library(agricolae)
x <- c(1,1,1,4,2,2,3,1,3,2,1,2,1,2,1,2)
y <- c(1,1,2,3,4,4,2,1,2,3,1,1,3,4,2,1,3,1,2)
kendall(x,y)

kruskal

Kruskal Wallis test and multiple comparison of treatments.

Description

It makes the multiple comparison with Kruskal-Wallis. The alpha parameter by default is 0.05. Post hoc test is using the criterium Fisher’s least significant difference. The adjustment methods include the Bonferroni correction and others.

Usage

kruskal(y, trt, alpha = 0.05, p.adj=c("none","holm","hommel","hochberg","bonferroni","BH","BY","fdr"), group=TRUE, main = NULL, console=FALSE)

Arguments

y response
trt treatment
alpha level signification
p.adj Method for adjusting p values (see p.adjust)
group TRUE or FALSE
main Title
console logical, print output

details

For equal or different repetition.
For the adjustment methods, see the function p.adjust.
p.adj = "none" is t-student.
Value

- **statistics**: Statistics of the model
- **parameters**: Design parameters
- **means**: Statistical summary of the study variable
- **comparison**: Comparison between treatments
- **groups**: Formation of treatment groups

Author(s)

Felipe de Mendiburu

References

Practical Nonparametrics Statistics. W.J. Conover, 1999

See Also

- BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples

```r
library(agricolae)
data(corn)
str(corn)
comparison<-with(corn,kruskal(observation,method,group=TRUE, main="corn"))
comparison<-with(corn,kruskal(observation,method,p.adj="bon",group=FALSE, main="corn"))
```

---

**kurtosis**: Finding the Kurtosis coefficient

Description

It obtains the value of the kurtosis for a normally distributed variable. The result is similar to SAS.

Usage

```r
kurtosis(x)
```

Arguments

- **x**: a numeric vector

Value

- **x**: The kurtosis of x
lastC

See Also

skewness

Examples

library(agricolae)
x<-c(3,4,5,2,3,4,5,6,4,NA,7)
kurtosis(x)
# value is -0.1517996

lastC

Setting the last character of a chain

Description

A special function for the group of treatments in the multiple comparison tests. Use plot.group.

Usage

lastC(x)

Arguments

x

letters

Value

x

Returns the last character of a string

Author(s)

Felipe de Mendiburu

See Also

plot.group

Examples

library(agricolae)
x<-c("a","ab","b","c","cd")
lastC(x)
# "a"  "b"  "b"  "c"  "d"
Description

LATEBLIGHT is a mathematical model that simulates the effect of weather, host growth and resistance, and fungicide use on asexual development and growth of Phytophthora infestans on potato foliage.

Usage

lateblight(WS, Cultivar, ApplSys, InocDate, LGR, IniSpor, SR, IE, LP, InMicCol, MatTime=c('EARLYSEASON', 'MIDSEASON', 'LATESEASON'), ...)

Arguments

WS object weather-severity
Cultivar chr
ApplSys chr
InocDate days
LGR num, see example
IniSpor num
SR num, see example
IE num, Initialization infection
LP num, latent period
InMicCol num
MatTime chr
... plot graphics parameters

Details

LATEBLIGHT Version LB2004 was created in October 2004 (Andrade-Piedra et al., 2005a, b and c), based on the C-version written by B.E. Ticknor ('BET 21191 modification of cbm8d29.c'), reported by Doster et al. (1990) and described in detail by Fry et al. (1991) (This version is referred as LB1990 by Andrade-Piedra et al. [2005a]). The first version of LATEBLIGHT was developed by Bruhn and Fry (1981) and described in detail by Bruhn et al. (1980).

Value

Ofile "Date","nday","MicCol","SimSeverity",...
Gfile "dates","nday","MeanSeverity","StDevSeverity"

Note

All format data for date is yyyy-mm-dd, for example "2000-04-22". change with function as.Date()
Author(s)

Jorge L. Andrade-Piedra (1) (j.andrade@cgar.org), Gregory A. Forbes (1) (g.forbes@cgiar.org),
Robert J. Hijmans (2) (rhijmans@ucdavis.edu), William E. Fry (3) (wef1@cornell.edu)

Hijmans Translation from SAS into R: Felipe de Mendiburu (1) (1) International Potato Center,
P.O. Box 1558, Lima 12, Peru (2) University of California, One Shields Avenue, Davis, California
95616, USA (3) Cornell University, 351 Plant Science, Ithaca, NY 14853, USA

References


See Also

weatherSeverity

Examples

library(agricolae)
f <- system.file("external/weather.csv", package="agricolae")
weather <- read.csv(f,header=FALSE)
f <- system.file("external/severity.csv", package="agricolae")
severity <- read.csv(f)
weather[,1]<-as.Date(weather[,1],format = "%m/%d/%Y")
# Parameters dates
dates<as.Date(dates)
EmergDate <- as.Date('2000/01/19')
Line x Tester Analysis

Description
It makes the Line x Tester Genetic Analysis. It also estimates the general and specific combinatory ability effects and the line and tester genetic contribution.

Usage
lineXtester(replications, lines, testers, y)
Arguments

replications  Replications
lines  Lines
testers  Testers
y  Variable, response

Details

ANOVA with parents and crosses
ANOVA for line X tester analysis
ANOVA for line X tester analysis including parents
Standard Errors for Combining Ability Effects.
Genetic Components.

... Proportional contribution of lines, testers and their interactions to total variance

Value

return anova(formula = Y ~ Replications + Treatments).
where the Treatments contains parents, crosses and crosses vs Parents.
The crosses contains Lines, Testers and its interaction.

Author(s)
Felipe de Mendiburu

References


See Also

AMMI

Examples

# see structure line by testers
library(agricolae)
# example 1
data(heterosis)
site1<-subset(heterosis,heterosis[,1]==1)
output1<-with(site1,lineXtester(Replication, Female, Male, v2))
# example 2
data(LxT)
str(LxT)
output2<-with(LxT,lineXtester(replication, line, tester, yield))
LSD.test

Multiple comparisons, "Least significant difference" and Adjust P-values

Description

Multiple comparisons of treatments by means of LSD and a grouping of treatments. The level by alpha default is 0.05. Returns p-values adjusted using one of several methods

Usage

LSD.test(y, trt, DFerror, MSerror, alpha = 0.05, p.adj=c("none","holm","hommel", "hochberg", "bonferroni", "BH", "BY", "fdr"), group=TRUE, main = NULL, console=FALSE)

Arguments

y
model(aov or lm) or answer of the experimental unit

trt
Constant (only y=model) or vector treatment applied to each experimental unit

DFerror
Degrees of freedom of the experimental error

MSerror
Means square error of the experimental

alpha
Level of risk for the test

p.adj
Method for adjusting p values (see p.adjust)

group
TRUE or FALSE

main
title of the study

console
logical, print output

Details

For equal or different repetition.
For the adjustment methods, see the function p.adjusted.
p.adj ="none" is t-student.

It is necessary first makes a analysis of variance.
if model=y, then to apply the instruction:
LSD.test(model, "trt", alpha = 0.05, p.adj=c("none","holm","hommel", "hochberg", "bonferroni", "BH", "BY", "fdr"), group=TRUE, main = NULL, console=FALSE)
where the model class is aov or lm.

Value

statistics
Statistics of the model

parameters
Design parameters

means
Statistical summary of the study variable

comparison
Comparison between treatments

groups
Formation of treatment groups
Author(s)
Felipe de Mendiburu

References

See Also
BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus, data=sweetpotato)
out <- LSD.test(model,"virus", p.adj="bonferroni")
#stargraph
# Variation range: max and min
plot(out)
#endgraph
# Old version LSD.test()
df<-df.residual(model)
MSerror<-deviance(model)/df
out <- with(sweetpotato,LSD.test(yield,virus,df,MSerror))
#stargraph
# Variation interquartil range: Q75 and Q25
plot(out, variation="IQR")
#endgraph
out<-LSD.test(model,"virus",p.adj="hommel",console=TRUE)
plot(out, variation="SD") # variation standard deviation

---
**LxT**

*Data Line by tester*

**Description**
Data frame with yield by line x tester.

**Usage**
data(LxT)
markers

Format
A data frame with 92 observations on the following 4 variables.

- **replication** a numeric vector
- **line** a numeric vector
- **tester** a numeric vector
- **yield** a numeric vector

Source
Biometrical Methods in Quantitative Genetic Analysis, Singh, Chaudhary. 1979

---

Data of molecular markers

---

Description
A partial study on 27 molecular markers.

Usage
data(markers)

Format
A data frame with 23 observations on the following 27 variables.

- **marker1** a numeric vector
- **marker2** a numeric vector
- **marker3** a numeric vector
- **marker4** a numeric vector
- **marker5** a numeric vector
- **marker6** a numeric vector
- **marker7** a numeric vector
- **marker8** a numeric vector
- **marker9** a numeric vector
- **marker10** a numeric vector
- **marker11** a numeric vector
- **marker12** a numeric vector
- **marker13** a numeric vector
- **marker14** a numeric vector
- **marker15** a numeric vector
Median.test

marker16 a numeric vector
marker17 a numeric vector
marker18 a numeric vector
marker19 a numeric vector
marker20 a numeric vector
marker21 a numeric vector
marker22 a numeric vector
marker23 a numeric vector
marker24 a numeric vector
marker25 a numeric vector
marker26 a numeric vector
marker27 a numeric vector

Source

International Potato Center Lima-Peru.

References

International Potato Center Lima-Peru.

Examples

library(agricolae)
data(markers)
str(markers)

Median.test               Median test. Multiple comparisons

Description

A nonparametric test for several independent samples. The median test is designed to examine whether several samples came from populations having the same median.

Usage

Median.test(y,trt,alpha=0.05,correct=TRUE,simulate.p.value = FALSE, group = TRUE, main = NULL,console=TRUE)
Arguments

- **y**: Variable response
- **trt**: Treatments
- **alpha**: error type I
- **correct**: a logical indicating whether to apply continuity correction when computing the test statistic for 2 groups. The correction will not be bigger than the differences themselves. No correction is done if simulate.p.value = TRUE.
- **simulate.p.value**: a logical indicating whether to compute p-values by Monte Carlo simulation
- **group**: TRUE or FALSE
- **main**: Title
- **console**: logical, print output

Details

The data consist of k samples of possibly unequal sample size.
Greater: is the number of values that exceed the median of all data and LessEqual: is the number less than or equal to the median of all data.

Value

- **statistics**: Statistics of the model
- **parameters**: Design parameters
- **medians**: Statistical summary of the study variable
- **comparison**: Comparison between treatments
- **groups**: Formation of treatment groups

Author(s)

Felipe de Mendiburu

References

Practical Nonparametrics Statistics. W.J. Conover, 1999

See Also

- BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group
Examples

library(agricolae)
# example 1
data(corn)
out<-with(corn,Median.test(observation,method,console=FALSE))
z<-bar.err(out$medians,variation = "range",ylim=c(0,120),
    space=2,border=4,col=3,density=10,angle=45)
# example 2
out<-with(corn,Median.test(observation,method,console=FALSE,group=FALSE))
print(out$comparison)

melon

Data of yield of melon in a Latin square experiment

Description

An irrigation system evaluation by exudation using four varieties of melon, under modality of sowing, SIMPLE ROW. The goal is to analyze the behavior of three hybrid melon varieties and one standard.

Usage

data(melon)

Format

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

row a numeric vector
col a numeric vector
variety a factor with levels V1 V2 V3 V4
yield a numeric vector

Details

Varieties: Hibrido Mission (V1); Hibrido Mark (V2); Hibrido Topflight (V3); Hibrido Hales Best Jumbo (V4).

Source

Tesis. "Evaluacion del sistema de riego por exudacion utilizando cuatro variedades de melon, bajo modalidad de siembra, SIMPLE HILERA". Alberto Angeles L. Universidad Agraria la Molina - Lima Peru.

References

Universidad Nacional Agraria la molina.
Examples

```r
library(agricolae)
data(melon)
str(melon)
```

---

**montecarlo**

*Random generation by Montecarlo*

Description

Random generation form data, use function density and parameters

Usage

```r
montecarlo(data, k, ...)
```

Arguments

- **data**: vector or object(hist, graph.freq)
- **k**: number of simulations
- **...**: Other parameters of the function density, only if data is vector

Value

Generate random numbers with empirical distribution.

Author(s)

Felipe de Mendiburu

See Also

density

Examples

```r
library(agricolae)
r<-rnorm(50, 10,2)
montecarlo(r, k=100, kernel="epanechnikov")
# other example
h<-hist(r,plot=FALSE)
montecarlo(h, k=100)
# other example
breaks<-c(0, 150, 200, 250, 300)
counts<-c(10, 20, 40, 30)
op<-par(mfrow=c(1,2),cex=0.8,mar=c(2,3,0,0))
h1<graph.freq(x=breaks,counts=counts,plot=FALSE)
r<-montecarlo(h, k=1000)
```
An evaluation of the number, weight and size of 24 native potato varieties.

Usage

data(natives)

Format

A data frame with 876 observations on the following 4 variables.

variety  a numeric vector
number   a numeric vector
weight   a numeric vector
size     a numeric vector

Source

International Potato Center. CIP - Lima Peru.
nonadditivity

Nonadditivity model test

Description

The resistance for the transformable nonadditivity, due to J. W. Tukey, is based on the detection of a curvilinear relation between y-est(y) and est(y). A freedom degree for the transformable nonadditivity.

Usage

nonadditivity(y, factor1, factor2, df, MSerror)

Arguments

- **y**: Answer of the experimental unit
- **factor1**: First treatment applied to each experimental unit
- **factor2**: Second treatment applied to each experimental unit
- **df**: Degrees of freedom of the experimental error
- **MSerror**: Means square error of the experimental

Details

Only two factor: Block and treatment or factor 1 and factor 2.

Value

P, Q and non-additivity analysis of variance

Author(s)

Felipe de Mendiburu

References

normal.freq

Examples

library(agricolae)
data(potato)
potato[,1]<-as.factor(potato[,1])
model<-lm(cutting ~ date + variety,potato)
df<-df.residual(model)
MSError<-deviance(model)/df
analysis<-with(potato,nonadditivity(cutting, date, variety, df, MSError))

normal.freq

Normal curve on the histogram

Description

A normal distribution graph elaborated from the histogram previously constructed. The average and variance are obtained from the data grouped in the histogram.

Usage

normal.freq(histogram, frequency=1, ...)

Arguments

histogram object constructed by the function hist
frequency 1=counts, 2=relative, 3=density
... Other parameters of the function hist

Author(s)

Felipe de Mendiburu

See Also

polygon.freq, table.freq, stat.freq, inter.freq, sturges.freq, join.freq, ogive.freq, graph.freq

Examples

library(agricolae)
data(growth)
#startgraph
h1<-with(growth,hist(height,col="green",xlim=c(6,14)))
normal.freq(h1,col="blue")
#endgraph
#startgraph
h2<-with(growth,graph.freq(height,col="yellow",xlim=c(6,14),frequency=2))
normal.freq(h2,frequency=2)
#endgraph
ogive.freq

Plotting the ogive from a histogram

Description

It plots the cumulative relative frequencies with the intervals of classes defined in the histogram.

Usage

ogive.freq(histogram,type="",xlab="",ylab="",axes="",las=1,...)

Arguments

- histogram: object created by the function hist() or graph.freq()
- type: what type of plot should be drawn. See plot()
- xlab: x labels
- ylab: y labels
- axes: TRUE or FALSE
- las: numeric in 0,1,2,3; the style of axis labels. see plot()
- ...: Parameters of the plot()

Value

Ogive points.

Author(s)

Felipe de Mendiburu

See Also

polygon.freq, table.freq, stat.freq, inter.freq, sturges.freq, join.freq, graph.freq, normal.freq

Examples

library(agricolae)
data(growth)
h<-graph.freq(growth$height,plot=FALSE)
points<-ogive.freq(h,col="red",frame=FALSE,
                 xlab="Height", ylab="Accumulated relative frequency", main="ogive")
plot(points,type="b",pch=16,las=1,bty="l")
Ordering the treatments according to the multiple comparison

Description

This function allows us to compare the treatments averages or the adding of their ranges with the minimal significant difference which can vary from one comparison to another one.

Usage

order.group(trt, means, N, MSerror, Tprob, std.err, parameter=1, snk=0, DError=NULL, alpha=NULL, sdtif=NULL, vartau=NULL, console)

Arguments

- `trt`: Treatments
- `means`: Means of treatment
- `N`: Replications
- `MSerror`: Mean square error
- `Tprob`: minimum value for the comparison
- `std.err`: standard error
- `parameter`: Constante 1 (Sd), 0.5 (Sx)
- `snk`: Constante = 1 (Student Newman Keuls)
- `DFerror`: Degrees of freedom of the experimental error
- `alpha`: Level of risk for the test
- `sdtif`: standard deviation of difference in BIB
- `vartau`: matrix var-cov in PBIB
- `console`: logical, print output

Details

This function was changed by orderPvalue function that use agricolae. Now the grouping in agricolae is with the probability of the treatments differences and alpha level.

Value

The output is data frame.

- `trt`: Treatment Levels, Factor
- `means`: height, Numeric
- `M`: groups levels, Factor
- `N`: replications, Numeric
- `std.err`: Standard error, Numeric
Note

It is considered 81 labels as maximum for the formation of groups, greater number will not have label.

Author(s)

Felipe de Mendiburu

See Also

orderPvalue

Examples

library(agricolae)
treatments <- c("A", "B", "C", "D", "E", "F")
means <- c(20, 40, 35, 72, 49, 58)
std.err <- c(1.2, 2, 1.5, 2.4, 1, 3.1)
replications <- c(4, 4, 3, 4, 3, 3)
MSerror <- 55.8
value.t <- 2.1314

groups<-order.group(treatments, means, replications, MSerror, value.t, std.err, console=FALSE)
print(groups)

---

orderPvalue

Grouping the treatments averages in a comparison with a minimum value

Description

When there are treatments and their respective values, these can be compared with a minimal difference of meaning.

Usage

orderPvalue(treatment, means, alpha, pvalue, console)

Arguments

treatment treatment
means means of treatment
alpha Alpha value, significant value to comparison
pvalue Matrix of probabilities to comparison
console logical, print output

Value

The means and groups for treatments.
Note

It is considered 81 labels as maximum for the formation of groups, greater number will not have label.

Author(s)

Felipe de Mendiburu

Examples

```r
library(agricolae)
treatments <- c("A", "B", "C")
means<-c(2,5,3)
alpha <- 0.05
pvalue<-matrix(1,nrow=3,ncol=3)
pvalue[1,2]<-pvalue[2,1]<-0.03
pvalue[1,3]<-pvalue[3,1]<-0.10
pvalue[2,3]<-pvalue[3,2]<-0.06
out<-orderPvalue(treatments,means,alpha,pvalue,console=TRUE)
barplot(out[,1],names.arg = row.names(out),col=colors()[84:87])
legend("topright",as.character(out$groups),pch=15,col=colors()[84:87],box.col=0)
```

**pamCIP**

*Data Potato Wild*

Description

Potato Wild

Usage

data(pamCIP)

Format

A data frame with 43 observations on the following 107 variables. Rownames: code and genotype’s name. column data: molecular markers.

Details

To study the molecular markers in Wild.

Source

Laboratory data.

References

International Potato Center Lima-Peru (CIP)
Examples

```r
library(agricolae)
data(pamCIP)
str(pamCIP)
```

```
paracsho       Data of Paracsho biodiversity
```

Description

A locality in Peru. A biodiversity.

Usage

```r
data(paracsho)
```

Format

A data frame with 110 observations on the following 6 variables.

```r
date a factor with levels 15-12-05 17-11-05 18-10-05 20-09-05 22-06-05 23-08-05 28-07-05
plot a factor with levels PARACSHO
Treatment a factor with levels CON SIN
Orden  a factor with levels COLEOPTERA DIPTERA HEMIPTERA HYMENOPTERA LEPIDOPTERA NEUROPTERA
       NOCTUIDAE
Family  a factor with levels AGROMYZIDAE ANTHOCORIDAE ANTHOMYLIIDAE BLEPHAROCERIDAE
       BRACONIDAE BROCONIDAE CALUPHORIDAE CECIDOMYIIDAE CHENEOPTERA CHNEUMONIDAE CICADELLIDAE
       CULICIDAE ERIOCIMPORTAIDAE HEMEROBIIDAE ICHNEUMONIDAE LOUCHAPIDAE MIRIDAE
       MUSCIDAE MUSICADAE MUSLIDAE MYCETOPHILIDAE MYCETOPHILIIIDAE NENPHALIDAE NOCLUIDAE
       NOCTERIDAE NOCTUIDAE PERALIDAE PIPUNCULIDAE PROCTOTRUPIDAE PSYLLIDAE PYRALIDAE
       SARCOPHAGIDAE SARCOPILAGIDAE SCATOPHAGIDAE SCATOPHAGIIDAE SCARIDAE SERSIDAE SYRPHIDAE
       TACHINIDAE TIPULIDAE
Number.of.specimens a numeric vector
```

Details

Country Peru, Department Junin, province Tarma, locality Huasahuasi.

Source

Entomology dataset.

References

International Potato Center.
path.analysis

Examples

```r
library(agricolae)
data(paracsho)
str(paracsho)
```

Description

If the cause and effect relationship is well defined, it is possible to represent the whole system of variables in a diagram form known as path-analysis. The function calculates the direct and indirect effects and uses the variables correlation or covariance.

Usage

```r
path.analysis(corr.x, corr.y)
```

Arguments

- `corr.x`: Matrix of correlations of the independent variables
- `corr.y`: vector of dependent correlations with each one of the independent ones

Details

It is necessary first to calculate the correlations.

Value

Direct and indirect effects and residual $\text{Effect}^2$.

Author(s)

Felipe de Mendiburu

References

Biometrical Methods in Quantitative Genetic Analysis, Singh, Chaudhary. 1979

See Also

`correlation`
Examples

# Path analysis. Multivarial Analysis. Anderson. Prentice Hall, pag 616
library(agricolae)
# Example 1
corr.x<- matrix(c(1,0.5,0.5,1),c(2,2))
corr.y<- rbind(0.6,0.7)
names<-c("X1","X2")
dimnames(corr.x)<-list(names,names)
dimnames(corr.y)<-list(names,"Y")
path.analysis(corr.x,corr.y)
# Example 2
# data of the progress of the disease related bacterial wilt to the ground
# for the component CE Ca K2 Cu
data(wilt)
data(soil)
x<-soil[,c(3,12,14,20)]
y<-wilt[,14]
cor.y<-correlation(y,x)$correlation
cor.x<-correlation(x)$correlation
path.analysis(cor.x,cor.y)

PBIB.test

Analysis of the Partially Balanced Incomplete Block Design

Description

Analysis of variance PBIB and comparison mean adjusted. Applied to resoluble designs: Lattices and alpha design.

Usage

PBIB.test(block, trt, replication, y, k, method = c("REML","ML","VC"), test = c("lsd","tukey"), alpha = 0.05, console = FALSE, group = TRUE)

Arguments

block  blocks
trt    Treatment
replication Replication
y       Response
k       Block size
method  Estimation method: REML, ML and VC
test    Comparison treatments
alpha   Significant test
console logical, print output
group   logical, groups
Details

Method of comparison treatment. lsd: least significant difference.
   tukey: Honestly significant difference.
   Estimate: specifies the estimation method for the covariance parameters.
   The REML is the default method. The REML specification performs residual (restricted) maximum
   likelihood, and The ML specification performs maximum likelihood, and the VC specifications
   apply only to variance component models.
   The PBIB.test() function can be called inside a function (improvement by Nelson Nazzicari, Ph.D.
   Bioinformatician)

Value

   ANOVA Analysis of variance
   method Estimation method: REML, ML and VC
   parameters Design parameters
   statistics Statistics of the model
   model Object: estimation model
   Fstat Criterion AIC and BIC
   comparison Comparison between treatments
   means Statistical summary of the study variable
   groups Formation of treatment groups
   vartau Variance-Covariance Matrix

Author(s)

   F. de Mendiburu

References

      19(1) 39-42.

See Also

   BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test,
   Median.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples

   require(agricolae)
   # alpha design
   Genotype<-c(paste("gen0",1:9,sep=""),paste("gen",10:30,sep=""))
   ntr<-length(Genotype)
   r<-2
k <- 3
s <- 10
obs <- ntr * r
b <- s * r
book <- design.alpha(Genotype, k, r, seed = 5)
book$book[, 3] <- gl(20, 3)
dbook <- book$book

# dataset
yield <- c(5, 2, 7, 6, 4, 9, 7, 6, 7, 9, 6, 2, 1, 1, 3, 2, 4, 6, 7, 9, 8, 7, 6, 4, 3, 2, 2, 1, 1, 2, 1, 2, 5, 4, 2, 7, 6, 5, 6, 4, 5, 7, 6, 5, 5, 4)
rm(Genotype)

# not run
# analysis
# require(nlme) # method = REML or LM in PBIB.test and require(MASS) method=VC
model <- with(dbook, PBIB.test(block, Genotype, replication, yield, k = 3, method = "VC"))
# model$ANOVA
# plot(model, las = 2)

---

**plot.AMMI**

**PLOT AMMI**

**Description**

Biplot AMMI.

**Usage**

```r
## S3 method for class 'AMMI'
plot(x, first = 1, second = 2, third = 3, type = 1, number = FALSE, gcol = NULL, ecol = NULL, angle = 25, lwd = 1.8, length = 0.1, xlab = NULL, ylab = NULL, xlim = NULL, ylim = NULL, ...)```

**Arguments**

- `x`: object AMMI
- `first`: position axis x, 0=Y-dependent, 1=PC1, 2=PC2, 3=PC3
- `second`: position axis y, 0=Y-dependent, 1=PC1, 2=PC2, 3=PC3
- `third`: position axis z, 0=Y-dependent, 1=PC1, 2=PC2, 3=PC3
- `type`: 1=biplot, 2=triplot
- `number`: TRUE or FALSE names or number genotypes
- `gcol`: genotype color
- `ecol`: environment color
- `angle`: angle from the shaft of the arrow to the edge of the arrow head
- `lwd`: parameter line width in function arrow
- `length`: parameter length in function arrow
- `xlab`: x labels
plot.graph.freq

  type=1 produce graphs biplot. type=2 produce graphs triplot, the components are normalizad in scale 0-1.

Author(s)
Felipe de Mendiburu

See Also
AMMI

Examples

library(agricolae)
data(plrv)
model<- with(plrv,AMMI(Locality, Genotype, Rep, Yield))
# biplot PC2 vs PC1
plot(model)
## plot PC1 vs Yield
plot(model,0,1,gcol="blue",ecol="green")
## triplot PC 2,3,4
if (requireNamespace("klaR", quietly = TRUE)) {
  plot(model,first=2,second=3,third=4, type=2,number=TRUE)
}

plot.graph.freq  Histogram

Description
In many situations it has intervals of class defined with its respective frequencies. By means of this function, the graphic of frequency is obtained and it is possible to superpose the normal distribution, polygon of frequency, Ojiva and to construct the table of complete frequency.

Usage

## S3 method for class 'graph.freq'
plot(x, breaks=NULL,counts=NULL,frequency=1,plot=TRUE,
nclass=NULL,xlab="",ylab="",axes="",las=1,...)
### Arguments

- **x**: a vector of values, a object hist(), graphFreq()
- **counts**: frequency and x is class intervals
- **breaks**: a vector giving the breakpoints between histogram cells
- **frequency**: 1=counts, 2=relative, 3=density
- **plot**: logic
- **nclass**: number of classes
- **xlab**: x labels
- **ylab**: y labels
- **axes**: TRUE or FALSE
- **las**: numeric in 0,1,2,3; the style of axis labels. see plot()
- **...**: other parameters of plot

### Value

- **breaks**: a vector giving the breakpoints between histogram cells
- **counts**: frequency and x is class intervals
- **mids**: center point in class
- **relative**: Relative frequency, height
- **density**: Density frequency, height

### Author(s)

Felipe de Mendiburu

### See Also

- `polygon.freq`, `table.freq`, `stat.freq`, `inter.freq`, `sturges.freq`, `join.freq`, `ogive.freq`, `normal.freq`

### Examples

```r
library(agricolae)
data(genxenv)
yield <- subset(genxenv$YLD, genxenv$ENV==2)
yield <- round(yield,1)
h<- graph.freq(yield,axes=FALSE, frequency=1, ylab="frequency",col="yellow")
axis(1,h$breaks)
axis(2,seq(0,20,0.1))
# To reproduce histogram.
h1 <- plot(h, col="blue", frequency=2, border="red", density=8, axes=FALSE,
xlab="YIELD",ylab="relative")
axis(1,h$breaks)
axis(2,seq(0,.4,0.1))
# summary, only frecuency
limits <- seq(10,40,5)
```
frequencies <- c(2, 6, 8, 7, 3, 4)

# start graph
h <- graph.freq(limits, counts = frequencies, col = "bisque", xlab = "Classes")
polygon.freq(h, col = "red")
title(main = "Histogram and polygon of frequency", ylab = ".frequency")

# end graph

# Statistics
measures <- stat.freq(h)
print(measures)

# frequency table full
round(table.freq(h), 2)

# start graph
ogive.freq(h, col = "red", type = "b", ylab = "Accumulated relative frequency", xlab = "Variable")

# only frequency polygon
h <- graph.freq(limits, counts = frequencies, border = FALSE, col = NULL, xlab = " ", ylab = "")
title(main = "Polygon of frequency", xlab = "Variable", ylab = "Frecuency")
polygon.freq(h, col = "blue")
grid(col = "brown")

# end graph

# Draw curve for Histogram
h <- graph.freq(yield, axes = FALSE, frequency = 3, ylab = "f(yield)", col = "yellow")
axis(1, h$breaks)
axis(2, seq(0, 0.18, 0.03), las = 2)
lines(density(yield), col = "red", lwd = 2)
title("Draw curve for Histogram")

---

plot.group

**Plotting the multiple comparison of means**

**Description**

It plots bars of the averages of treatments to compare. It uses the objects generated by a procedure of comparison like LSD, HSD, Kruskall, Waller-Duncan, Friedman or Durbin. It can also display the 'average' value over each bar in a bar chart.

**Usage**

```r
## S3 method for class 'group'
plot(x, variation = c("range","IQR","SE","SD"), decreasing = TRUE, 
     horiz = FALSE, col = NULL, xlim = NULL, ylim = NULL, main = NULL, cex = NULL, hy = 0, ...)  
```

**Arguments**

- `x` Object created by a test of comparison
- `variation` in lines by range, IQR, standard deviation or error
decreasing Logical, decreasing order of the mean
horiz Horizontal or vertical image
col line colors
xlim optional, axis x limits
ylim optional, axis y limits
main optional, main title
cex optional, group label size
hy optional, default =0, sum group label position
... Parameters of the function barplot()

Details
The output is a vector that indicates the position of the treatments on the coordinate axes.

Author(s)
Felipe de Mendiburu

See Also
BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, waller.test

Examples
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus,data=sweetpotato)
comparison<-LSD.test(model,"virus",alpha=0.01,group=TRUE)
#startgraph
op<-par(cex=1.5)
plot(comparison,horiz=TRUE,xlim=c(0,50),las=1)
title(cex.main=0.8,main="Comparison between treatment means",xlab="Yield",ylab="Virus")
#endgraph
par(op)

Data for an analysis in split-plot

Description
Experimental data in blocks, factor A in plots and factor B in sub-plots.

Usage
data(plots)
Format

A data frame with 18 observations on the following 5 variables.

- block a numeric vector
- plot a factor with levels p1 p2 p3 p4 p5 p6
- A a factor with levels a1 a2
- B a factor with levels b1 b2 b3
- yield a numeric vector

Source

International Potato Center. CIP

Examples

library(agricolae)
data(plots)
str(plots)
plots[,1] <-as.factor(plots[,1])
# split-plot analysis
model <- aov(yield ~ block + A + Error(plot)+ B + A:B, data=plots)
summary(model)
b<-nlevels(plots$B)
a<-nlevels(plots$A)
r<-nlevels(plots$block)
dfa <- df.residual(model$plot)
Ea <-deviance(model$plot)/dfa
dfb <- df.residual(model$Within)
Eb <-deviance(model$Within)/dfb
Eab <- (Ea +(b-1)*Eb)/(b*r)
# Satterthwaite
dfab<-(Ea +(b-1)*Eb)^2/(Ea^2/dfa +((b-1)*Eb)^2/dfb)
# Comparison A, A(b1), A(b2), A(b3)
comparison1 <-with(plots,LSD.test(yield,A,dfa,Ea))
comparison2 <-with(plots,LSD.test(yield[B=="b1"],A[B=="b1"],dfab,Eab))
comparison3 <-with(plots,LSD.test(yield[B=="b2"],A[B=="b2"],dfab,Eab))
comparison4 <-with(plots,LSD.test(yield[B=="b3"],A[B=="b3"],dfab,Eab))
# Comparison B, B(a1), B(a2)
comparison5 <-with(plots,LSD.test(yield,B,dfb,Eb))
comparison6 <-with(plots,LSD.test(yield[A=="a1"],B[A=="a1"],dfb,Eb))
comparison7 <-with(plots,LSD.test(yield[A=="a2"],B[A=="a2"],dfb,Eb))

plrv

Data clones from the PLRV population

Description

Six environments: Ayacucho, La Molina 02, San Ramon 02, Huancayo, La Molina 03, San Ramon 03.
Usage
data(plrv)

Format
A data frame with 504 observations on the following 6 variables.

Genotype  a factor with levels 102.18 104.22 121.31 141.28 157.26 163.9 221.19 233.11
235.6 241.2 255.7 314.12 317.6 319.20 320.16 342.15 346.2 351.26 364.21 402.7
405.2 406.12 427.7 450.3 506.2 Canchan Desiree Unica
Locality  a factor with levels Ayac Hyo-02 LM-02 LM-03 SR-02 SR-03
Rep  a numeric vector
WeightPlant  a numeric vector
WeightPlot  a numeric vector
Yield  a numeric vector

Source
International Potato Center Lima-Peru

References
International Potato Center Lima-Peru

Examples
library(agricolae)
data(plrv)
str(plrv)

---

polygon.freq  The polygon of frequency on the histogram

Description
The polygon is constructed single or on a histogram. It is necessary to execute the function previously hist.

Usage
polygon.freq(histogram, frequency=1, ...)

Arguments

  histogram   Object constructed by the function hist
  frequency   numeric, counts(1), relative(2) and density(3)
  ...         Other parameters of the function hist
Author(s)
Felipe de Mendiburu Delgado

See Also
polygon.freq, table.freq, stat.freq, inter.freq, sturges.freq, join.freq, graph.freq, normal.freq

Examples
library(agricolae)
data(growth)
#startgraph
h1<-with(growth,hist(height,border=FALSE,xlim=c(6,14)))
polygon.freq(h1,frequency=1,col="red")
#endgraph
#startgraph
h2<-with(growth,graph.freq(height,frequency=2,col="yellow",xlim=c(6,14)))
polygon.freq(h2,frequency=2,col="red")
#endgraph

Description
A study on the yield of two potato varieties performed at the CIP experimental station.

Usage
data(potato)

Format
A data frame with 18 observations on the following 4 variables.
date a numeric vector
variety a factor with levels Canchan Unica
harvest a numeric vector
cutting a numeric vector

Source
Experimental data.

References
International Potato Center
Examples

```r
library(agricolae)
data(potato)
str(potato)
```

---

**ralstonia**

*Data of assessment of the population in the soil R.solanacearum*

---

**Description**

The assessment of the population of R.solanacearum on the floor took place after 48 hours of infestation, during days 15, 29, 43, 58, and 133 days after the infestation soil. More information on soil data(soil).

**Usage**

```r
data(ralstonia)
```

**Format**

A data frame with 13 observations on the following 8 variables.

- `place` a factor with levels Chmar Chz Cnt1 Cnt2 Cnt3 Hco1 Hco2 Hco3 Hyo1 Hyo2 Namora SR1 SR2
- `Day2` a numeric vector
- `Day15` a numeric vector
- `Day29` a numeric vector
- `Day43` a numeric vector
- `Day58` a numeric vector
- `Day73` a numeric vector
- `Day133` a numeric vector

**Details**

Logarithm average counts of colonies on plates containing half of M-SMSA 3 repetitions (3 plates by repetition) incubated at 30 degrees centigrade for 48 hours. log(1+UFC/g soil)

**Source**

Experimental field, 2004. Data kindly provided by Dr. Sylvie Priou, Liliam Gutarra and Pedro Aley.

**References**

International Potato Center. CIP - Lima Peru.
Examples

```r
library(agricolae)
data(ralstonia)
str(ralstonia)
```

**Description**

It makes the regressions homogeneity test for a group of treatments where each observation presents a linearly dependent reply from another one. There is a linear function in every treatment. The objective is to find out if the linear models of each treatment come from the same population.

**Usage**

```r
reg.homog(trt, x, y)
```

**Arguments**

- `trt` treatment
- `x` independent variable
- `y` dependent variable

**Value**

- list objects:
  - Number regressions.
  - Residual.
  - Difference of regression.
  - DF.homogeneity (homogeneity degree free).
  - DF.Residual (degree free error).
  - F.value. Test statistics.
  - P.value. P Value (Significant Criterion. conclusion

**Author(s)**

Felipe de Mendiburu

**References**

Book in Spanish: Metodos estadisticos para la investigacion. Calzada Benza 1960
Examples

```r
library(agricolae)
data(frijol)
evaluation<-with(frijol,reg.homog(technology,index,production))

# Example 2. Applied Regression Analysis a Research tools
# & Software. Pacific Grove. California.
# Statistics/probability. Series
LineNumber<-c(rep("39","30"),rep("52","30"))
PlantingDate<-rep(c("16","20","21"),20)
HeadWt <- c(2.5,3.0,2.2,2.2,2.8,1.8,3.1,2.8,1.6,4.3,2.7,2.1,2.5,2.6,3.3,3.4,3,
2.8,3.8,3.8,2.6,3.2,4.3,2.6,3.6,1.7,2.6,4.2,3.1,3.5,1.6,2.0,4.0,1.5,2.4,2.8,
1.4,1.9,3.1,1.7,2.8,4.2,1.3,1.7,3.7,1.7,3.2,3.0,1.6,2.0,2.2,1.4,2.2,2.3,1.0,
2.2,3.8,1.5,2.2,2.0,1.6)
Ascorbic <-c(51,65,54,55,52,59,45,41,66,42,51,54,53,41,45,50,45,49,50,51,49,
52,45,55,56,61,49,49,42,68,58,52,78,55,70,75,67,57,70,61,58,84,67,47,71,68,
56,72,58,72,62,63,68,56,54,66,72,60,72)
trt<-paste(LineNumber,PlantingDate,sep="-")
output<-reg.homog(trt,HeadWt,Ascorbic)
```

REGW.test  

**Ryan, Einot and Gabriel and Welsch multiple range test**

Description

Multiple range tests for all pairwise comparisons, to obtain a confident inequalities multiple range tests.

Usage

```r
REGW.test(y, trt, DError, MSError, alpha = 0.05, group=TRUE, main = NULL,console=FALSE)
```

Arguments

- **y**  
  model(aov or lm) or answer of the experimental unit
- **trt**  
  Constant( only y=model) or vector treatment applied to each experimental unit
- **DFerror**  
  Degree free
- **MSError**  
  Mean Square Error
- **alpha**  
  Significant level
- **group**  
  TRUE or FALSE
- **main**  
  Title
- **console**  
  logical, print output
It is necessary first makes a analysis of variance.

if y = model, then to apply the instruction:
REGW.test (model, "trt", alpha = 0.05, group = TRUE, main = NULL, console = FALSE)
where the model class is aov or lm.

Value

- statistics: Statistics of the model
- parameters: Design parameters
- regw: Critical Range Table
- means: Statistical summary of the study variable
- comparison: Comparison between treatments
- groups: Formation of treatment groups

Author(s)

Felipe de Mendiburu

References

Multiple comparisons theory and methods. Departament of statistics the Ohio State University.

See Also

BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test.
Median.test, PBIB.test, scheffe.test, SNK.test, waerden.test, waller.test, plot.group

Examples

library(agricolae)
data(sweetpotato)
model<-aov(yield~virus,data=sweetpotato)
out<- REGW.test(model,"virus",
main="Yield of sweetpotato. Dealt with different virus")
print(out)
REGW.test(model,"virus",alpha=0.05,console=TRUE,group=FALSE)
Resampling to find the optimal number of markers

Description
This process finds the curve of CV for a different number of markers which allows us to determine the number of optimal markers for a given relative variability. A method of the curvature.

Usage
resampling.cv(A, size, npoints)

Arguments
- A: data frame or matrix of binary data
- size: number of re-samplings
- npoints: Number of points to consider the model

Value
lm(formula = CV ~ I(1/marker))
Table with variation coefficient by number of markers

Author(s)
Felipe de Mendiburu

References

See Also
cv.similarity, similarity

Examples
library(agricolae)
#example table of molecular markers
data(markers)
study<-resampling.cv(markers, size=1, npoints=15)
#
# Results of the model
summary(study$model)
coef<-coef(study$model)
py<-predict(study$model)
Rsq<-summary(study$model)$"r.squared"
table.cv <- data.frame(study$table.cv, estimate=py)
print(table.cv)

# Plot CV
#startgraph
limy<-max(table.cv[,2])+10
plot(table.cv[,c(1,2)],col="red",frame=FALSE,xlab="number of markers",
ylim=c(10,limy), ylab="CV",cex.main=0.8,main="Estimation of the number of markers")
ty<-quantile(table.cv[,2],1)
tx<-median(table.cv[,1])
tz<-quantile(table.cv[,2],0.95)
text(tx,ty, cex=0.8,as.expression(substitute(CV == a + frac(b,markers),
list(a=round(coef[1],2),b=round(coef[2],2))))

limx<-max(table.cv[,1])
tx<-median(table.cv[,1])
tx<-quantile(table.cv[,1],0.95)
text(tx,tz,cex=0.8,as.expression(substitute(R^2==r,list(r=round(Rsq,3)))))
# Plot CV = a + b/n.markers
fy<function(x,a,b) a+b/x
x<-seq(2,max(table.cv[,1]),length=50)
y <- coef[1] + coef[2]/x
lines(x,y,col="blue")
#grid(col="brown")
rug(table.cv[,1])
#endgraph

resampling.model  Resampling for linear models

Description
This process consists of finding the values of P-value by means of a re-sampling (permutation) process along with the values obtained by variance analysis.

Usage
resampling.model(model,data,k,console=FALSE)

Arguments
model model in R
data data for the study of the model
k number of re-samplings
console logical, print output

Value
Model solution with resampling.

Author(s)
Felipe de Mendiburu
References


See Also

simulation.model

Examples

#example 1 Simple linear regression
library(agricolae)
data(clay)
model<="ralstonia ~ days"
analysis<-resampling.model(model,clay,k=2,console=TRUE)

#example 2 Analysis of variance: RCD
data(sweetpotato)
model<="yield~virus"
analysis<-resampling.model(model,sweetpotato,k=2,console=TRUE)

#example 3 Simple linear regression
data(Glycoalkaloids)
model<="HPLC ~ spectrophotometer"
analysis<-resampling.model(model,Glycoalkaloids,k=2,console=TRUE)

#example 4 Factorial in RCD

data(potato)
potato[,1]<-as.factor(potato[,1])
potato[,2]<-as.factor(potato[,2])
model<="cutting~variety + date + variety:date"
analysis<-resampling.model(model,potato,k=2,console=TRUE)

rice

Data of Grain yield of rice variety IR8

Description

The data correspond to the yield of rice variety IR8 (g/m2) for land uniformity studies. The growing
area is 18x36 meters.

Usage

data(rice)
**Format**

A data frame with 36 observations on the following 18 variables.

- V1 a numeric vector
- V2 a numeric vector
- V3 a numeric vector
- V4 a numeric vector
- V5 a numeric vector
- V6 a numeric vector
- V7 a numeric vector
- V8 a numeric vector
- V9 a numeric vector
- V10 a numeric vector
- V11 a numeric vector
- V12 a numeric vector
- V13 a numeric vector
- V14 a numeric vector
- V15 a numeric vector
- V16 a numeric vector
- V17 a numeric vector
- V18 a numeric vector

**Details**

Table 12.1 Measuring Soil Heterogeneity

**Source**


**References**


**Examples**

```r
library(agricolae)
data(rice)
str(rice)
```
Description

Mother/Baby Trials allow farmers and researchers to test best-bet technologies or new cultivars. Evaluation of advanced Clones of potato in the Valley of Rio Chillon - PERU (2004)

Usage

data(RioChillon)

Format

The format is list of 2:
1. mother: data.frame: 30 obs. of 3 variables:
   - block (3 levels)
   - clon (10 levels)
   - yield (kg.)
2. babies: data.frame: 90 obs. of 3 variables:
   - farmer (9 levels)
   - clon (10 levels)
   - yield (kg.)

Details

1. Replicated researcher-managed "mother trials" with typically 10 treatments evaluated in small plots.
2. Unreplicated "baby trials" with 10 treatments evaluated in large plots.
3. The "baby trials" with a subset of the treatments in the mother trial.

Source

Experimental field.

References

International Potato Center. CIP - Lima Peru.

Examples

# Analisys the Mother/Baby Trial Design
library(agricolae)
data(RioChillon)
# First analysis the Mother Trial Design.
model<-aov(yield ~ block + clon, RioChillon$mother)
anova(model)
cv.model(model)
# Multiple comparisons, scheffe

## Description

Scheffe 1959, method is very general in that all possible contrasts can be tested for significance and confidence intervals can be constructed for the corresponding linear. The test is conservative.

## Usage

```r
scheffe.test(y, trt, DFerror, MSerror, Fc, alpha = 0.05, group=TRUE, main = NULL, console=FALSE)
```

## Arguments

- `y`: model(aov or lm) or answer of the experimental unit
- `trt`: Constant( only y=model) or vector treatment applied to each experimental unit
- `DFerror`: Degrees of freedom
- `MSerror`: Mean Square Error
- `Fc`: F Value
- `alpha`: Significant level
- `group`: TRUE or FALSE
- `main`: Title
- `console`: logical, print output

## Details

It is necessary first makes a analysis of variance.

if `y = model`, then to apply the instruction:
```
scheffe.test(model, "trt", alpha = 0.05, group = TRUE, main = NULL, console = FALSE)
```
where the model class is aov or lm.

```r
comparison<-with(RioChillon$mother,LSD.test(yield,clon, 18, 4.922, group=TRUE))
# Second analysis the babies Trial.
comparison<-with(RioChillon$babies,friedman(farmer,clon, yield, group=TRUE))
# Third
# The researcher makes use of data from both mother and baby trials and thereby obtains
# information on suitability of new technologies or cultivars
# for different agro-ecologies and acceptability to farmers.
```
similarity

Value

statistics Statistics of the model
parameters Design parameters
means Statistical summary of the study variable
comparison Comparison between treatments
groups Formation of treatment groups

Author(s)

Felipe de Mendiburu

References


See Also

BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, SNK.test, waerden.test, waller.test, plot.group

Examples

library(agricolae)
data(sweetpotato)
model<-aov(yield~virus, data=sweetpotato)
comparison <- scheffe.test(model,"virus", group=TRUE,console=TRUE,
main="Yield of sweetpotato\nDealt with different virus")
# Old version scheffe.test()
df<-df.residual(model)
MSError<-deviance(model)/df
Fc<-(anova(model)
out <- with(sweetpotato,scheffe.test(yield, virus, df, MSError, Fc))
print(out)

similarity Matrix of similarity in binary data

Description

It finds the similarity matrix of binary tables (1 and 0).

Usage

similarity(A)
**simulation.model**

**Argument**

- **A**
  - Matrix, data binary

**Value**

- Distance matrix. Class = dist.

**Author(s)**

Felipe de Mendiburu

**See Also**

- cv.similarity, resampling.cv

**Examples**

```r
#example table of molecular markers
library(agricolae)
data(markers)
distance<-similarity(markers)
#startgraph
tree<-hclust(distance,method="mcquitty")
plot(tree,col="blue")
#endgraph
```

---

**Description**

This process consists of validating the variance analysis results using a simulation process of the experiment. The validation consists of comparing the calculated values of each source of variation of the simulated data with respect to the calculated values of the original data. If in more than 50 percent of the cases they are higher than the real one, then it is considered favorable and the probability reported by the ANOVA is accepted, since the P-Value is the probability of \( F > F_{\text{value}} \).

**Usage**

```r
simulation.model(model,file, categorical = NULL,k,console=FALSE)
```

**Arguments**

- **model**
  - Model in R
- **file**
  - Data for the study of the model
- **categorical**
  - position of the columns of the data that correspond to categorical variables
- **k**
  - Number of simulations
- **console**
  - logical, print output
**Value**

- **model output linear model, lm**
- **simulation anova simulation**

**Author(s)**

Felipe de Mendiburu

**See Also**

`resampling.model`

**Examples**

```r
library(agricolae)
#example 1
data(clay)
model<="ralstonia ~ days"
simulation.model(model,clay,k=15,console=TRUE)
#example 2
data(sweetpotato)
model<="yield~virus"
simulation.model(model,sweetpotato,categorical=1,k=15,console=TRUE)
#example 3
data(Glycoalkaloids)
model<="HPLC ~ spectrophotometer"
simulation.model(model,Glycoalkaloids,k=15,console=TRUE)
#example 4
data(potato)
model<="cutting~date+variety"
simulation.model(model,potato,categorical=c(1,2,3),k=15,console=TRUE)
```

---

**sinRepAmmi**  
*Data for AMMI without repetition*

**Description**

Data frame for AMMI analysis with 50 genotypes in 5 environments.

**Usage**

```r
data(sinRepAmmi)
```
skewness

Format
A data frame with 250 observations on the following 3 variables.

ENV  a factor with levels A1 A2 A3 A4 A5
GEN  a numeric vector
YLD  a numeric vector

Source
Experimental data.

References
International Potato Center - Lima Peru.

Examples
library(agricolae)
data(sinRepAmmi)
str(sinRepAmmi)

---

skewness  Finding the skewness coefficient

Description
It returns the skewness of a distribution. It is similar to SAS.

Usage
skewness(x)

Arguments
x  a numeric vector

Value
The skewness of x.

See Also
kurtosis

Examples
library(agricolae)
x<-c(3,4,5,2,3,4,NA,5,6,4,7)
skewness(x)
# value is 0.3595431, is slightly asimetrica (positive) to the right
**SNK.test**

*Student-Newman-Keuls (SNK)*

**Description**

SNK is derived from Tukey, but it is less conservative (finds more differences). Tukey controls the error for all comparisons, where SNK only controls for comparisons under consideration. The level by alpha default is 0.05.

**Usage**

```r
SNK.test(y, trt, DError, MSerror, alpha = 0.05, group = TRUE, main = NULL, console = FALSE)
```

**Arguments**

- `y`: model(aov or lm) or answer of the experimental unit
- `trt`: Constant( only y=model) or vector treatment applied to each experimental unit
- `DError`: Degree free
- `MSerror`: Mean Square Error
- `alpha`: Significant level
- `group`: TRUE or FALSE
- `main`: Title
- `console`: logical, print output

**Details**

It is necessary first makes a analysis of variance.

if `y = model`, then to apply the instruction:

```r
SNK.test(model, "trt", alpha = 0.05, group = TRUE, main = NULL, console = FALSE)
```

where the model class is aov or lm.

**Value**

- `statistics`: Statistics of the model
- `parameters`: Design parameters
- `snk`: Critical Range Table
- `means`: Statistical summary of the study variable
- `comparison`: Comparison between treatments
- `groups`: Formation of treatment groups

**Author(s)**

Felipe de Mendiburu
soil

References


See Also

BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, waerden.test, waller.test, plot.group

Examples

library(agricolae)
data(sweetpotato)
model<-aov(yield~virus,data=sweetpotato)
out <- SNK.test(model,"virus", console=TRUE, main="Yield of sweetpotato. Dealt with different virus")
print(SNK.test(model,"virus", group=FALSE))
# version old SNK.test()
df<-df.residual(model)
MSError<-deviance(model)/df
out <- with(sweetpotato,SNK.test(yield,virus,df,MSError, group=TRUE))
print(out$groups)

soil

Data of soil analysis for 13 localities

Description

We analyzed the physical and chemical properties of different soils, as full characterization of soil and special analysis of micro-elements. These analyses were conducted in the laboratory analysis of soils, plants, water and fertilizers in the La Molina National Agrarian University (UNALM). To which the different soil samples were dried to the environment, screened (mesh 0.5xo, 5 mm) and sterilized by steam 4 to 5 hours with a Lindinger Steam aerator SA150 and SA700, with the possible aim of eliminating bacteria saprophytic or antagonists to prevent the growth of bacteria (R.solanacearum).

Usage

data(soil)

Format

A data frame with 13 observations on the following 23 variables.

place  a factor with levels Chmar Chz Cnt1 Cnt2 Cnt3 Hco1 Hco2 Hco3 Hyo1 Hyo2 Namora SR1 SR2
pH    a numeric vector
soil

EC  a numeric vector, electrical conductivity
CaCO3 a numeric vector
M0  a numeric vector
CIC a numeric vector
P   a numeric vector
K   a numeric vector
sand a numeric vector
slime a numeric vector
clay a numeric vector
Ca  a numeric vector
Mg  a numeric vector
K2  a numeric vector
Na  a numeric vector
Al_H a numeric vector
K_Mg a numeric vector
Ca_Mg a numeric vector
B   a numeric vector
Cu  a numeric vector
Fe  a numeric vector
Mn  a numeric vector
Zn  a numeric vector

Details
Cnt1= Canete, Cnt2=Valle Dulce(Canete), Cnt3=Valle Grande(Canete), Chz=Obraje-Carhuaz(Ancash),
Chmar=Chucmar-Chota(Huanuco, Hco1= Mayobamba-Chinchao(Huanuco), Hco2=Nueva Independencia-
Chinchao(Huanuco), Hco3=San Marcos-Umari(Huanuco), Hyo1=La Victoria-Huancayo(Junin), Hyo1=El
Tambo-Huancayo(Junin), Namora=Namora(Cajamarca), SR1= El Milagro-San Ramon(Junin), Sr2=La
Chinchana-San Ramon(Junin).

Source
Experimental field, 2004. Data Kindly provided by Dr. Sylvie Priou, Liliam Gutarra and Pedro
Aley.

References
International Potato Center - Lima, PERU.

Examples
library(agricolae)
data(soil)
str(soil)
Description

The variance analysis of a split plot design is divided into two parts: the plot-factor analysis and the sub-plot factor analysis.

Usage

`sp.plot(block, pplot, splot, Y)`

Arguments

- `block`: replications
- `pplot`: main-plot Factor
- `splot`: sub-plot Factor
- `Y`: Variable, response

Details

The split-plot design is specifically suited for a two-factor experiment on of the factors is assigned to main plot (main-plot factor), the second factor, called the subplot factor, is assigned into subplots. The model is mixed, the blocks are random and the study factors are fixed applied according to the design.

Value

ANOVA: Splip plot analysis

Author(s)

Felipe de Mendiburu

References


See Also

`ssp.plot`, `strip.plot`, `design.split`, `design.strip`
Examples

```r
library(agricolae)
data(plots)
model<-with(plots,sp.plot(block,A,B,yield))  # with aov
plots[,1]<-as.factor(plots[,1])
AOV <- aov(yield ~ block + A*B + Error(block/A),data=plots)
summary(AOV)
```

ssp.plot

### Split-split-Plot analysis

**Description**

The variance analysis of a split-split plot design is divided into three parts: the main-plot, subplot and sub-subplot analysis.

**Usage**

```r
ssp.plot(block, pplot, splot, ssplot, Y)
```

**Arguments**

- `block`: replications
- `pplot`: Factor main plot
- `splot`: Factor subplot
- `ssplot`: Factor sub-subplot
- `Y`: Variable, response

**Details**

The split-split-plot design is an extension of the split-plot design to accommodate a third factor: one factor in main-plot, other in subplot and the third factor in sub-subplot. The model is mixed, the blocks are random and the study factors are fixed applied according to the design.

**Value**

ANOVA: Split Split plot analysis

**Author(s)**

Felipe de Mendiburu

**References**

stability.nonpar

See Also

sp.plot, strip.plot, design.split, design.strip

Examples

# Statistical procedures for agricultural research, pag 143
# Grain Yields of Three Rice Varieties Grown under
# Three Management practices and Five Nitrogen levels; in a
# split-split-plot design with nitrogen as main-plot,
# management practice as subplot, and variety as sub-subplot
# factors, with three replications.
library(agricolae)
f <- system.file("external/ssp.csv", package="agricolae")
ssp<-read.csv(f)
model<-with(ssp,ssp.plot(block,nitrogen,management,variety,yield))
gla<-model$gl.a; glb<-model$gl.b; glc<-model$gl.c
Ea<-model$Ea; Eb<-model$Eb; Ec<-model$Ec
op<-par(mfrow=c(1,3),cex=0.6)
out1<-with(ssp,LSD.test(yield,nitrogen,gla,Ea,console=TRUE))
out2<-with(ssp,LSD.test(yield,management,glb,Eb,console=TRUE))
out3<-with(ssp,LSD.test(yield,variety,glc,Ec,console=TRUE))
plot(out1,xlab="Nitrogen",las=1,variation="IQR")
plot(out2,xlab="Management",variation="IQR")
plot(out3,xlab="Variety",variation="IQR")
# with aov
ssp$block<-factor(ssp$block)
ssp$nitrogen<-factor(ssp$nitrogen)
ssp$management<-factor(ssp$management)
ssp$variety<-factor(ssp$variety)
AOV<-aov(yield ~ block + nitrogen*management*variety + Error(block/nitrogen/management),data=ssp)
summary(AOV)
par(op)

---

stability.nonpar Nonparametric stability analysis

Description

A method based on the statistical ranges of the study variable per environment for the stability analysis.

Usage

stability.nonpar(data, variable = NULL, ranking = FALSE, console=FALSE)
### Arguments

- **data**: First column the genotypes following environment
- **variable**: Name of variable
- **ranking**: logical, print ranking
- **console**: logical, print output

### Value

- **ranking**: data frame
- **statistics**: Statistical analysis chi square test

### Author(s)

Felipe de Mendiburu

### References


### See Also

- [stability.par](#)

### Examples

```r
library(agricolae)
data(haynes)

if (interactive()) {  
stability.nonpar(haynes,"AUDPC",ranking=TRUE,console=TRUE)  
}

# Example 2  
data(CIC)

data1<-CIC$comas[,c(1,6,7,17,18)]
data2<-CIC$oxapampa[,c(1,6,7,19,20)]
cic <- rbind(data1,data2)

means <- by(cic[,5], cic[,c(2,1)], function(x) mean(x,na.rm=TRUE))
means <-as.data.frame(means[,])
cic.mean<-data.frame(genotype=row.names(means),means)
cic.mean<-delete.na(cic.mean,"greater")

out<-stability.nonpar(cic.mean)
out$ranking
out$statistics
```
Description

This procedure calculates the stability variations as well as the statistics of selection for the yield and the stability. The averages of the genotype through the different environment repetitions are required for the calculations. The mean square error must be calculated from the joint variance analysis.

Usage

```r
stability.par(data, rep, MSerror, alpha=0.1, main=NULL, cova = FALSE, name.cov=NULL, file.cov=0, console=FALSE)
```

Arguments

- `data`: matrix of averages, by rows the genotypes and columns the environment
- `rep`: Number of repetitions
- `MSerror`: Mean Square Error
- `alpha`: Label significant
- `main`: Title
- `cova`: Covariable
- `name.cov`: Name covariable
- `file.cov`: Data covariable
- `console`: logical, print output

Details

Stable (i) determines the contribution of each genotype to GE interaction by calculating var(i); (ii) assigns ranks to genotypes from highest to lowest yield receiving the rank of 1; (iii) calculates protected LSD for mean yield comparisons; (iv) adjusts yield rank according to LSD (the adjusted rank labeled Y); (v) determines significance of var(i) usign an aproximate F-test; (vi) assigns stability rating (S) as follows: -8, -4 and -2 for var(i) significant at the 0.01, 0.05 and 0.10 probability levels, and 0 for nonsignificant var(i) ( the higher the var(i), the less stable the genotype); (vii) sums adjusted yield rank, Y, and stability rating, S, for each genotype to determine YS(i) statistic; and (viii) calculates mean YS(i) and identifies genotypes (selection) with YS(i) > mean YS(i).

Value

- `analysis`: Analysis of variance
- `statistics`: Statistics of the model
- `stability`: summary stability analysis
Descriptive measures of grouped data

By this process the variance and central measures are found: average, medium and mode of grouped data.

**Usage**

```r
stat.freq(histogram)
```

**Arguments**

- `histogram` Object created by function `hist()`
strip.plot

Value
Statistics of grouped data.

Author(s)
Felipe de mendiburu

See Also
polygon.freq, table.freq, graph.freq, inter.freq, sturges.freq, join.freq, ogive.freq, normal.freq

Examples
library(agricolae)
data(growth)
grouped<-with(growth,hist(height,plot=FALSE))
measures<-stat.freq(grouped)
print(measures)

strip.plot Strip-Plot analysis

Description
The variance analysis of a strip-plot design is divided into three parts: the horizontal-factor analysis, the vertical-factor analysis, and the interaction analysis.

Usage
strip.plot(BLOCK, COL, ROW, Y)

Arguments
- BLOCK replications
- COL Factor column
- ROW Factor row
- Y Variable, response

Details
The strip-plot design is specifically suited for a two-factor experiment in which the desired precision for measuring the interaction effects between the two factors is higher than that for measuring the main effect two factors.
sturges.freq

Class intervals for a histogram, the rule of Sturges

Description

if k=0 then classes: k = 1 + log(n,2). if k > 0, fixed nclass.

Usage

sturges.freq(x,k=0)

Arguments

x         vector
k         constant
Value
Statistics of sturges for a histogram.

Author(s)
Felipe de mendiburu

References

See Also
polygon.freq, table.freq, stat.freq, inter.freq, graph.freq, join.freq, ogive.freq, normal.freq

Examples
library(agricolae)
data(natives)
classes<-with(natives,sturges.freq(size))
# information of the classes
breaks <- classes$breaks
breaks
#startgraph
# Histogram with the established classes
h<-with(natives,graph.freq(size,breaks,frequency=1, col="yellow",axes=FALSE,
     xlim=c(0,0.12),main="",xlab="",ylab=""))
axis(1,breaks,las=2)
axis(2,seq(0,400,50),las=2)
title(main="Histogram of frequency\nSize of the tubercule of the Oca",
     xlab="Size of the oca", ylab="Frequency")
#endgraph
sweetpotato

**Arguments**

- `object` Object by function `graph.freq()
- `...` other parameters of graphic

**Value**

Frequency table.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>Lower limit class</td>
</tr>
<tr>
<td>Upper</td>
<td>Upper limit class</td>
</tr>
<tr>
<td>Main</td>
<td>class point</td>
</tr>
<tr>
<td>Frequency</td>
<td>Frequency</td>
</tr>
<tr>
<td>Percentage</td>
<td>Percentage frequency</td>
</tr>
<tr>
<td>CF</td>
<td>Cumulative frequency</td>
</tr>
<tr>
<td>CPF</td>
<td>Cumulative Percentage frequency</td>
</tr>
</tbody>
</table>

**Author(s)**

Felipe de Mendiburu

**See Also**

`polygon.freq`, `stat.freq`, `graph.freq`, `inter.freq`, `sturges.freq`, `join.freq`, `ogive.freq`, `normal.freq`

**Examples**

```r
library(agricolae)
data(growth)
h2<-with(growth,graph.freq(height,plot=FALSE))
print(summary(h2),row.names=FALSE)
```

---

**sweetpotato**

Data of sweetpotato yield

**Description**

The data correspond to an experiment with costanero sweetpotato made at the locality of the Tacna department, southern Peru. The effect of two viruses (Spfmv and Spcsv) was studied. The treatments were the following: CC (Spcsv) = Sweetpotato chlorotic dwarf, FF (Spfmv) = Feathery mottle, FC (Spfmv y Spcsv) = Viral complex and OO (witness) healthy plants. In each plot, 50 sweetpotato plants were sown and 12 plots were employed. Each treatment was made with 3 repetitions and at the end of the experiment the total weight in kilograms was evaluated. The virus transmission was made in the cuttings and these were sown in the field.
**Usage**

```
data(sweetpotato)
```

**Format**

A data frame with 12 observations on the following 2 variables.

- **virus**: a factor with levels `cc fc ff oo`
- **yield**: a numeric vector

**Source**

Experimental field.

**References**

International Potato Center. CIP - Lima Peru

**Examples**

```
library(agricolae)
data(sweetpotato)
str(sweetpotato)
```

---

**Description**

It finds the absolute, relative and accumulated frequencies with the class intervals defined from a previously calculated histogram by the "hist" of R function.

**Usage**

```
table.freq(object)
```

**Arguments**

- **object**: Object by function `graph.freq()`
tapply.stat

Statistics of data grouped by factors

Description
This process lies in finding statistics which consist of more than one variable, grouped or crossed by factors. The table must be organized by columns between variables and factors.

Usage
`tapply.stat(y, x, stat = "mean")`

Arguments
- `y`: data.frame variables
- `x`: data.frame factors
- `stat`: Method
Value

Statistics of quantitative variables by categorical variables.

Author(s)

Felipe de Mendiburu

Examples

library(agricolae)
# case of 1 single factor
data(sweetpotato)
tapply.stat(sweetpotato[,2],sweetpotato[,1],mean)
with(sweetpotato,tapply.stat(yield,virus,sd))
with(sweetpotato,tapply.stat(yield,virus,function(x) max(x)-min(x)))
with(sweetpotato,tapply.stat(yield,virus,
function(x) quantile(x,0.75,6)-quantile(x,0.25,6)))
# other case
data(cotton)
with(cotton,tapply.stat(yield,cotton[,c(1,3,4)],mean))
with(cotton,tapply.stat(yield,cotton[,c(1,4)],max))
# Height of pijuayo
data(growth)
with(growth,tapply.stat(height, growth[,2:1], function(x) mean(x,na.rm=TRUE)))

vark

Variance K, ties, Kendall

Description

The Kendall method in order to find the K variance.

Usage

vark(x, y)

Arguments

x Vector
y vector

Details

Script in C to R.

Value

varian of K for Kendall’s tau
waerden.test

Author(s)
Felipe de Mendiburu

References

See Also
cor.matrix, cor.vector, cor.mv

Examples
library(agricolae)
x <-c(1,1,1,4,2,2,3,1,3,2,1,2,3,2,1,2,1,2,1) y <-c(1,1,2,3,4,4,2,1,2,3,1,1,3,4,2,1,3,1,2) vark(x,y)

Description
Multiple comparisons. The van der Waerden (Normal Scores)

Usage
waerden.test(y, trt, alpha=0.05, group=TRUE, main=NULL, console=FALSE)

Arguments
\begin{itemize}
\item \texttt{y} \hspace{1cm} Variable response
\item \texttt{trt} \hspace{1cm} Treatments
\item \texttt{alpha} \hspace{1cm} Significant level
\item \texttt{group} \hspace{1cm} TRUE or FALSE
\item \texttt{main} \hspace{1cm} Title
\item \texttt{console} \hspace{1cm} logical, print output
\end{itemize}

Details
The data consist of k samples of possibly unequal sample size. The post hoc test is using the criterium Fisher’s least significant difference (LSD).
waller

Value

<table>
<thead>
<tr>
<th>statistic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>statistics</td>
<td>Statistics of the model</td>
</tr>
<tr>
<td>parameters</td>
<td>Design parameters</td>
</tr>
<tr>
<td>means</td>
<td>Statistical summary of the study variable</td>
</tr>
<tr>
<td>comparison</td>
<td>Comparison between treatments</td>
</tr>
<tr>
<td>groups</td>
<td>Formation of treatment groups</td>
</tr>
</tbody>
</table>

Author(s)

Felipe de Mendiburu

References

Practical Nonparametrics Statistics. W.J. Conover, 1999

See Also

BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waller.test, plot.group

Examples

library(agricolae)
# example 1
data(corn)
out1<-with(corn,waerden.test(observation,method,group=TRUE))
print(out1$groups)
plot(out1)
out2<-with(corn,waerden.test(observation,method,group=FALSE))
print(out2$comparison)
# example 2
data(sweetpotato)
out<-with(sweetpotato,waerden.test(yield,virus,alpha=0.01,group=TRUE))
print(out)

waller

Computations of Bayesian t-values for multiple comparisons

Description

A Bayes rule for the symmetric multiple comparisons problem.

Usage

waller(K, q, f, Fc)
Arguments

K Is the loss ratio between type I and type II error
q Numerator Degrees of freedom
f Denominator Degrees of freedom
Fc F ratio from an analysis of variance

Details

K-RATIO (K): value specifies the Type 1/Type 2 error seriousness ratio for the Waller-Duncan test. Reasonable values for KRATIO are 50, 100, and 500, which roughly correspond for the two-level case to ALPHA levels of 0.1, 0.05, and 0.01. By default, the procedure uses the default value of 100.

Value

Waller value for the Waller and Duncan test.

Author(s)

Felipe de Mendiburu

References


See Also

waller.test

Examples

# Table Duncan-Waller K=100, F=1.2 pag 649 Steel & Torry
library(agricolae)
K<-100
Fc<-1.2
q<-c(8,10,12,14,16,20,40,100)
f<-c(seq(4,20,2),24,30,40,60,120)
n<-length(q)
m<-length(f)
W.D <-rep(0,n*m)
dim(W.D)<-c(n,m)
for (i in 1:n) {
  for (j in 1:m) {
    W.D[i,j]<-waller(K, q[i], f[j], Fc)
```r
W.D<-round(W.D,2)
dimnames(W.D)<-list(q,f)
print(W.D)
```

**waller.test**  
*Multiple comparisons, Waller-Duncan*

**Description**

The Waller-Duncan k-ratio t test is performed on all main effect means in the MEANS statement. See the K-RATIO option for information on controlling details of the test.

**Usage**

```r
waller.test(y, trt, DFerror, MSerror, Fc, K = 100, group=TRUE, main = NULL, console=FALSE)
```

**Arguments**

- `y` model(aov or lm) or answer of the experimental unit
- `trt` Constant( only y=model) or vector treatment applied to each unit
- `DFerror` Degrees of freedom
- `MSerror` Mean Square Error
- `Fc` F Value
- `K` K-RATIO
- `group` TRUE or FALSE
- `main` Title
- `console` logical, print output

**Details**

It is necessary first makes a analysis of variance.

K-RATIO (K): value specifies the Type 1/Type 2 error seriousness ratio for the Waller-Duncan test. Reasonable values for KRATIO are 50, 100, and 500, which roughly correspond for the two-level case to ALPHA levels of 0.1, 0.05, and 0.01. By default, the procedure uses the default value of 100.

if `y = model`, then to apply the instruction:

```r
waller.test(model, "trt", alpha = 0.05, group = TRUE, main = NULL, console = FALSE)
```

where the model class is aov or lm.
Value

| statistics | Statistics of the model |
| parameters | Design parameters |
| means | Statistical summary of the study variable |
| comparison | Comparison between treatments |
| groups | Formation of treatment groups |

Author(s)

Felipe de Mendiburu

References


Steel & Torry & Dickey. Third Edition 1997 Principles and procedures of statistics a biometrical approach

See Also

BIB.test, DAU.test, duncan.test, durbin.test, friedman, HSD.test, kruskal, LSD.test, Median.test, PBIB.test, REGW.test, scheffe.test, SNK.test, waerden.test, plot.group

Examples

```r
library(agricolae)
data(sweetpotato)
model<-aov(yield~virus, data=sweetpotato)
out <- waller.test(model,"virus", group=TRUE)
#startgraph
oldpar<-par(mfrow=c(2,2))
# variation: SE is error standard
# variation: range is Max - Min
bar.err(out$means,variation="SD",horiz=TRUE,xlim=c(0,45),bar=FALSE,
col=colors()[25],space=2,main="Standard deviation",las=1)
bar.err(out$means,variation="SE",horiz=FALSE,ylim=c(0,45),bar=FALSE,
col=colors()[15],space=2,main="SE",las=1)
bar.err(out$means,variation="range",ylim=c(0,45),bar=FALSE,col="green",
space=3,main="Range = Max - Min",las=1)
bar.group(out$groups,horiz=FALSE,ylim=c(0,45),density=8,col="red",
main="Groups",las=1)
#endgraph
# Old version HSD.test()
df<-df.residual(model)
MSError<-deviance(model)/df
```
weatherSeverity

weatherSeverity <- function(weather, severity, dates, EmergDate, EndEpidDate, NoReadingsH, RHthreshold)

Arguments
- weather: object, see example
- severity: object, see example
- dates: vector dates
- EmergDate: date
- EndEpidDate: date
- NoReadingsH: num, 1
- RHthreshold: num, percentage

Details
- Weather and severity

Value
- Wfile: "Date", "Rainfall", "Tmp", "HumidHrs", "humidtmp"
- EmergDate: date
- EndEpidDate: date

Note
- All format data for date is yyyy-mm-dd, for example "2000-04-22". change with function as.Date()

See Also
- lateblight
### Examples

```r
library(agricolae)
f <- system.file("external/weather.csv", package="agricolae")
weather <- read.csv(f, header=FALSE)
f <- system.file("external/severity.csv", package="agricolae")
severity <- read.csv(f)
weather[,1]<-as.Date(weather[,1], format = "%m/%d/%Y")
# Parameters dates and threshold
dates<-as.Date(dates)
EmergDate <- as.Date("2000-01-19")
EndEpidDate <- as.Date("2000-04-22")
dates<-as.Date(dates)
NoReadingsH<- 1
RHthreshold <- 90
#--------------------------
WS<-weatherSeverity(weather, severity, dates, EmergDate, EndEpidDate, NoReadingsH, RHthreshold)
```

---

### Data of Bacterial Wilt (AUDPC) and soil

#### Description

Percentage of bacterial wilt and area under the curve of disease progression (AUDPC) relative tomato plants transplanted in different soil types artificially infested with *R. solanacearum* 133 days before.

#### Usage

`data(wilt)`

#### Format

A data frame with 13 observations on the following 15 variables.

- `place` a factor with levels Chmar Chz Cnt1 Cnt2 Cnt3 Hco1 Hco2 Hco3 Hyo1 Hyo2 Namora SR1 SR2
- `Day7` a numeric vector
- `Day11` a numeric vector
- `Day15` a numeric vector
- `Day19` a numeric vector
- `Day23` a numeric vector
- `Day27` a numeric vector
- `Day31` a numeric vector
- `Day35` a numeric vector
- `Day39` a numeric vector
Day43 a numeric vector
Day47 a numeric vector
Day51 a numeric vector
AUDPC a numeric vector
relative a numeric vector

Details
Percentajes bacterial wilt. Day7 = evaluated to 7 days, Days11 = evaluated to 11 days. see data(soil) and data(ralstonia)

Source
Experimental field, 2004. Data Kindly provided by Dr. Sylvie Priou, Liliam Gutarra and Pedro Aley.

References
International Potato Center. CIP - Lima Peru.

Examples
library(agricolae)
data(wilt)
days<-c(7,11,15,19,23,27,31,35,39,43,47,51)
AUDPC<-audpc(wilt[,1],days)
relative<-audpc(wilt[,1],days,type="relative")

Description
The yacon (Smallanthus sonchifolius) is a plant native to the Andes, considered a traditional crop in Peru and natural source of FOS, which is a type of carbohydrate that can not be digested by the and the human body that have joined several beneficial properties in health, such as improve the absorption of calcium, reducing the level of triglycerides and cholesterol and stimulate better gastrointestinal function.

Usage
data(yacon)
Format

A data frame with 432 observations on the following 19 variables.

- **locality**: a factor with levels Cajamarca, Lima, Oxapampa in PERU
- **site**: a numeric vector
- **dose**: a factor with levels `F0` `F150` `F80`
- **entry**: a factor with levels AKW5075 AMM5136 AMM5150 AMM5163 ARB5125 CLLUNC118 P1385 SAL136
- **replication**: a numeric vector, replications
- **height**: a numeric vector, plant height, centimeters
- **stalks**: a numeric vector, number of stalks
- **wfr**: a numeric vector, weight of fresh roots, grams
- **wff**: a numeric vector, weight of fresh foliage, grams
- **wfk**: a numeric vector, weight fresh kroner, grams
- **roots**: a numeric vector, matter of dried roots, grams
- **FOS**: a numeric vector, fructo-oligosaccharides, percentage
- **glucose**: a numeric vector, percentage
- **fructose**: a numeric vector, percentage
- **sucrose**: a numeric vector, percentage
- **brix**: a numeric vector, degrees Brix
- **foliage**: a numeric vector, matter dry foliage, grams
- **dry**: a numeric vector, dry matter kroner, grams
- **IH**: a numeric vector, Index harvest, 0 to 1

Details

Proportion or fraction of the plant that is used (seeds, fruit, root) on dry basis. Part usable in a proportion of total mass dissected. Plant of frijol, weight = 100g and frijol = 50g then, IH = 50/100 = 0.5 or 50 percentage. Degrees Brix is a measurement of the mass ratio of dissolved sugar to water in a liquid.

Source

CIP. Experimental field, 2003, Data Kindly provided by Ivan Manrique and Carolina Tasso.

References

International Potato Center. CIP - Lima Peru.

Examples

```r
library(agricolae)
data(yacon)
str(yacon)
```
Description

applied to designs: complete block, latin square, graeco, split plot, strip plot, lattice, alpha lattice, Augmented block, cyclic, Balanced Incomplete Block and factorial.

Usage

zigzag(outdesign)

Arguments

outdesign output design

Value

fieldbook Remuneration of serpentine plots.

Author(s)

Felipe de Mendiburu

See Also

design.ab, design.alpha, design.bib, design.split, design.cyclic, design.dau, design.graeco, design.lattice, design.lsd, design.rcbd, design.strip

Examples

library(agricolae)
trt<-letters[1:5]
r<-4
outdesign <- design.rcbd(trt,r,seed=9)
fieldbook <- zigzag(outdesign)
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