

Package ‘classicaltest’

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Title Classical Test Theory (CTT) Analysis

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Description Functions for classical test theory analysis, following methods presented by Wu et al. (2006) <[doi:10.1007/978-981-10-3302-5](https://doi.org/10.1007/978-981-10-3302-5)>.

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classicaltest

Classical test theory item and person statistics

Description

Calculates several item and person statistics following `ctitem()`, and `ctperson()`.

Usage

```
classicaltest(
  x,
  key = NULL,
  categories = NULL,
  wt = NULL,
  listwise = FALSE,
  recScore = TRUE,
  administered = NULL
)
```

Arguments

<code>x</code>	a data frame or matrix. For multiple choice items, columns can be numeric or strings and keys should be provided. For polytomous items, all columns should be numeric.
<code>key</code>	a vector indicating the keys to score the data. If NULL items are assumed as polytomous. Default is NULL.
<code>categories</code>	a vector indicating all possible categories. If NULL, this vector will be created with all the non-NA values present in <code>x</code> . Default is NULL.
<code>wt</code>	a numeric vector of total weights. Default is NULL.
<code>listwise</code>	only consider complete data (remove rows with NAs). Default is FALSE.
<code>recScore</code>	a logical value indicating if the total score for should be calculated based only on valid values. Thus, if TRUE: <code>rowMeans(x, na.rm = TRUE)*apply(x, 1L, function(k) sum(!is.na(k)))</code> ; if FALSE: <code>rowMeans(x, na.rm = TRUE)*ncol(x)</code> . Default is TRUE. If <code>listwise</code> , this argument is meaningless.
<code>administered</code>	a logical matrix indicating which items where administered. The dimensions should be the same as <code>x</code> . If NULL all items are considered administered.

Value

A list with item and person statistics.

Examples

```
data(dichodata)
data(polydata)
data(dichokey)

# Data preparation
## Random weights creation
set.seed(1919)
wt <- sample(x = 1:4, size = nrow(dichodata), replace = TRUE)

# Item and person analysis for multiple choice items
classicaltest(x = dichodata, key = dichokey, categories = c('A','B','C','D'), wt = wt)

# Item and person analysis for polytomous items
classicaltest(x = polydata, key = NULL, wt = wt)
```

correct

Scoring correct/incorrect answers

Description

Transforms a data frame or matrix with raw answers into a data frame with 1s (correct answers) and 0s (incorrect answers).

Usage

```
correct(x, key, navalue = NA)
```

Arguments

x	a data frame or matrix.
key	a vector indicating the keys to score the data.
navalue	a single value indicating the score of NAs.

Value

A data frame with 1s for correct answers and 0s for incorrect answers.

Examples

```
data(dichodata)
data(dichokey)

# NAs as NAs
head(dichodata)
ex1 <- correct(x = dichodata, key = dichokey, navalue = NA)
head(ex1)
```

```
# NAs as 0s
head(dichodata)
ex2 <- correct(x = dichodata, key = dichokeys, na.value = 0)
head(ex2)
```

ctitem

Classical test theory item statistics

Description

Calculates several item statistics, including: item mean, frequencies, proportions, valid proportions, and correlations between item responses and the total score.

Usage

```
ctitem(
  x,
  key = NULL,
  categories = NULL,
  wt = NULL,
  listwise = FALSE,
  recScore = TRUE
)
```

Arguments

x	a data frame or matrix. For multiple choice items, columns can be numeric or strings and keys should be provided. For polytomous items, all columns should be numeric.
key	a vector indicating the keys to score the data. If NULL items are assumed as polytomous. Default is NULL.
categories	a vector indicating all possible categories. If NULL, this vector will be created with all the non-NA values present in x. Default is NULL.
wt	a numeric vector of total weights. Default is NULL.
listwise	only consider complete data (remove rows with NAs). Default is FALSE.
recScore	a logical value indicating if the total score for should be calculated based only on valid values. Thus, if TRUE: <code>rowMeans(x, na.rm = TRUE)*apply(x, 1L, function(k) sum(!is.na(k)))</code> ; if FALSE: <code>rowMeans(x, na.rm = TRUE)*ncol(x)</code> . Default is TRUE. If listwise, this argument is meaningless.

Details

If keys are provided, items are assumed as dichotomous and transformed into 1s and 0s, where 1s are correct answers. Then, point-biserial correlations are estimated between the item and the total score (PBtotal), the item and the score without the item (PBrest), between each response category and the total score.

If keys are not provided, data must be numeric, items are assumed as polytomous and data will not be transformed. For polytomous, Pearson's correlations are estimated between the item and the total score (PEtotal), the item and the score without the item (PErest), between each response category and the total score.

Value

A data frame with item statistics.

Examples

```
data(dichodata)
data(polydata)
data(dichokey)

# Data preparation
## Random weights creation
set.seed(1919)
wt <- sample(x = 1:4, size = nrow(dichodata), replace = TRUE)

# Item analysis for multiple choice items
ctitem(x = dichodata, key = dichokey, categories = c('A','B','C','D'), wt = wt)

# Item analysis for polytomous items
ctitem(x = polydata, key = NULL, wt = wt)
```

ctperson

Classical test theory person statistics

Description

Calculates persons statistics given a data frame (or matrix) of corrected data. Including sum scores, number of administered items, number of answered items, proportion of correct items (for dichotomous data), and mean score by item (for polytomous data).

Usage

```
ctperson(x, administered = NULL)
```

Arguments

`x` a data frame or matrix of corrected data (only containing 1s, 0s, and NAs).
`administered` a logical matrix indicating which items were administered. The dimensions should be the same as `x`. If NULL all items are considered administered.

Value

A data frame with person statistics.

Examples

```
# Data preparation
## Corrected data
corr <- correct(x = dichodata, key = dichokey, navalue = NA)
## Random administered matrix
set.seed(1919)
admin <- sample(x = 0:1, size = nrow(corr)*ncol(corr), replace = TRUE, prob = c(.05,.95))
admin <- matrix(data = as.logical(admin),nrow = nrow(corr))
head(admin)

# Person statistics with all items administered
ex1 <- ctperson(x = corr)
head(ex1)

# Person statistics with NOT all items administered
ex2 <- ctperson(x = corr, administered = admin)
head(ex2)
```

dichodata

Simulated multiple choice data with 1000 cases, and 20 items

Description

Simulated multiple choice data with 1000 cases, and 20 items

dichokey

Keys for dichodata

Description

Keys for dichodata

dichotomize	<i>Dichotomize data</i>
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Description

Converts a matrix or data frame into a dichotomized data frame. Where each possible category is assigned a 1 or a 0.

Usage

```
dichotomize(x, id = NULL, categories = NULL, NAasNA = TRUE, sortByItem = FALSE)
```

Arguments

<code>x</code>	a data frame or matrix.
<code>id</code>	a vector of unique values indicating the ids of the cases. If NULL, an id will be created following <code>id <- 1L:nrow(x)</code> . Default is NULL.
<code>categories</code>	a vector indicating all possible categories. If NULL, this vector will be created with all the non-NA values present in <code>x</code> . Default is NULL.
<code>NAasNA</code>	a logical value indicating if NAs should be kept as NAs. If FALSE, NAs will be 0s. Default is TRUE.
<code>sortByItem</code>	a logical value indicating if the resulting data frame should be order by item names, on the contrary, by ids. Default is FALSE.

Value

A data frame with columns for the ids, the item names and all the possible item categories, where 1s mean the person answered that category for that item, and 0s mean the contrary.

Examples

```
data(dichodata)

# Dichotomize with all present categories
ex1 <- dichotomize(dichodata, categories = NULL)
head(ex1)

# Dichotomize with fixed set of categories
ex2 <- dichotomize(dichodata, categories = c('A','B','C','D'))
head(ex2)

# Dichotomize with NAs as 0s
ex3 <- dichotomize(dichodata, NAasNA = FALSE)
head(ex3)
```

pointbiserial *Point-biserial correlation*

Description

Estimates the point-biserial correlation coefficient between dichotomous items and the person's score.

Usage

```
pointbiserial(x, wt = NULL, exclude = FALSE, listwise = FALSE, recScore = TRUE)
```

Arguments

x	a numeric data frame or matrix containing only two categories.
wt	a numeric vector of total weights. Default is NULL.
exclude	a logical value indicating if the point-biserial correlation should be calculated excluding the item from the total score. Default is FALSE.
listwise	only consider complete data (remove rows with NAs). Default is FALSE.
recScore	a logical value indicating if the total score for should be calculated based only on valid values. Thus, if TRUE: <code>rowMeans(x, na.rm = TRUE)*apply(x, 1L, function(k) sum(!is.na(k)))</code> ; if FALSE: <code>rowMeans(x, na.rm = TRUE)*ncol(x)</code> . Default is TRUE. If <code>listwise</code> , this argument is meaningless.

Value

A numeric vector with the point-biserial correlation coefficients by item.

Examples

```
data(dichodata)
data(dichokey)

# Data preparation
## Corrected data
corr <- correct(x = dichodata, key = dichokey, navalue = NA)
## Random weights creation
set.seed(1919)
wt <- sample(x = 1:4, size = nrow(corr), replace = TRUE)

# Correlations without weights
pointbiserial(x = corr, wt = NULL)

# Correlations with weights
pointbiserial(x = corr, wt = wt)

# Correlations if item is excluded
```



```
pointbiserial(x = corr, exclude = TRUE)

# Correlations if NAs are considered 0s (recScore)
pointbiserial(x = corr, recScore = FALSE)

# Correlations with listwise
pointbiserial(x = corr, listwise = TRUE)
```

polydata

Simulated polytomous items data with 1000 cases, and 20 items

Description

Simulated polytomous items data with 1000 cases, and 20 items

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