R Functions
for
Bayesian Analysis of Two Dependent 2x2 Contingency Tables

A. Main program

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dependent.main(data, iter) — *MC algorithm for the analysis of two dependent 2x2 contingency tables*

Description

Returns the output of the MC algorithm.

Usage

```
dependent.main( data, iter )
```

Arguments

data	Data array. Default is the sixcities.data
iter	Number of iterations. Default iter=5000

Details

This function implements MC algorithm and provides as output the conditional probabilities, cell probabilities and odds ratios of the Bayesian analysis of the two dependent 2x2 contingency tables.

Values

z matrix	Matrix for generated latent variables. Each row represents the parameters generated in the corresponding iteration of the MC algorithm while each column represents latent variables z_1 and z_2.
w matrix	Matrix for generated conditional probabilities. Each row represents the parameters generated in the corresponding iteration of the MC algorithm while each column represents the generated conditional probabilities w_{11}, w_{12}, w_{21} and w_{22}.
p matrix	Matrix for generated cell probabilities. Each row represents the parameters generated in the corresponding iteration of the MC algorithm while each column represents the generated table probabilities $p_{11.1}$, $p_{11.2}$, $p_{21.1}$ and $p_{21.2}$.
theta matrix	Matrix for generated odds ratios. Each row represents the parameters generated in the corresponding iteration of the MC algorithm while each column represents the generated odds ratios θ_1, and θ_2.

See Also

In this program an additional function randomz is called for the generation of latent data.

Examples

```
# Six cities data is the illustrative example
# 5000 iterations for six cities data

result<- dependent.main( sixcities.data,  iter=5000)
```

---

randomz *Function for the generation of the latent data*

Description

This function generates the latent data **z**

Usage

```
randomz(n, k)
```

Arguments

n	Data array. Default is the sixcities.data
k	Index for latent data. If k=1 gives z_1, if k=2 gives z_2.

Details

This function generates the latent data z_1 and z2 from the corresponding marginal distribution (3.9).

Values

z	Returns the latent data z_1 or z_2 depending on the value set to index k

Examples

```
# Simulation of the latent variable z1
  z1<- randomz(n, k=1)
```

B. Program for the replicated data

Warnings: to use this program you must first run the main program.

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replications *MC algorithm for model diagnostics*

Description

Return the posterior predictive values of the cell frequencies and the corresponding odds ratios.

Usage

replications(a, iterations)

Arguments

a	Value set in case of a zero cell frequency. Default value is a=0.5
iterations	Number of iterations. Default is iterations=5000

Details

This function generates the replicated data as described in the algorithm presented in subsection 3.2 (steps 5-7).

Values

k1	Gives the value of the probability $P(\theta_1>1)$ using the replicated data.
k2	Gives the value of the probability $P(\theta_2>1)$ using the replicated data.
k3	Gives the value of the probability $P(\theta_2/\theta_1>1)$ using the replicated data.
n111rep	Matrix for the replicated values of the cell frequency $n_{11.1}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.
n121rep	Matrix for the replicated values of the cell frequency $n_{12.1}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

n211rep — Matrix for the replicated values of the cell frequency $n_{21.1}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

n221rep — Matrix for the replicated values of the cell frequency $n_{22.1}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

n112rep — Matrix for the replicated values of the cell frequency $n_{11.2}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

n122rep — Matrix for the replicated values of the cell frequency $n_{12.2}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

n212rep — Matrix for the replicated values of the cell frequency $n_{21.2}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

n222rep — Matrix for the replicated values of the cell frequency $n_{22.2}$. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

theta1rep — Matrix for the replicated values of the odds ratio θ_1. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

theta2rep — Matrix for the replicated values of the odds ratio θ_2. Each row represents the parameters generated in the corresponding iteration of the MC algorithm.

See Also

In this program two additional functions function1 and function2 are called for the generation of the predictive values.

Examples

```
# 5000 iterations for the generation of the replicated data

replications(a=0.5, iterations=5000)
```

function1 *Function for the generation of the predictive values* $n_{11.1}$ *and* $n_{21.1}$

Description

This function generates the predictive values of frequencies $n_{11.1}$ and $n_{21.1}$.

Usage

```
function1( p, w, z, n )
```

Arguments

p	Generated probability from the MC output of dependent.main program
w	Generated conditional probability from the MC output of dependent.main program
z	Generated latent from the MC output of dependent.main program
n	Sum of row cell frequencies

Details

This function generates the replicated data $n_{11.1}$ and $n_{21.1}$ from the marginal distribution given in step 5a page 12.

Values

k	Returns the value of the replicated data $n_{11.1}$ or $n_{21.1}$.

Examples

```
# Generation of the replicated data n11.1 at step i. P[i,1] is the i-th value of p11.1,
# W[i,1] is the i-th value of w11, Z[i,1] is the i-th value of z1 and ns[1] is the sum of
# the 1st row of the contingency table (all computed in dependent.main )

n111rep[i,1]<- function1( P[i, 1], W[i,1], Z[i,1], ns[1] )
```

function2 *Function for the generation of the predictive values* $n_{11.2}$ *and* $n_{21.2}$

Description

This function generates the predictive values of frequencies $n_{11.2}$ and $n_{21.2}$.

Usage

```
function2( p, w, z, n )
```

Arguments

y	Value of the replicated data $n_{11.1}$ or $n_{21.1}$
w	Generated conditional probability from the MC output of dependent.main program
z	Generated latent from the MC output of dependent.main program
n	Sum of row cell frequencies

Details

This function generates the replicated data $n_{11.2}$ and $n_{21.2}$ from the marginal distribution given in step 5b page 12.

Values

l	Returns the value of the replicated data $n_{11.2}$ or $n_{21.2}$.

Examples

```
# Generation of the replicated data n11.2 at step i. n211rep[i,1] is the i-th value of the
#replicated value of n21.1.
# W[i,4] is the i-th value of w22, Z[i,2] is the i-th value of z2 and ns[2] is the sum of
# the 2nd row of the contingency table (all computed in dependent.main )

n212rep[i,1]<- function2( n211rep[i,4], W[i,4], Z[i,2], ns[2] )
```

sixcities.data *Six cities dataset*

Description

The object sixcities.data is a 2x2x2 array describing the cross-classification of wheeze status and maternal smoking on 537 children examined at ages 7 and 10. This example is very popular in the literature first presented by Ware et al, 1984. It was used as an illustrated example.

Format

A 2x2x2 array with

rows	representing maternal smoking (no vs. yes)
columns	representing wheeze status (no vs. yes)
layers	representing time (age 7 and age 10)

Source

Ware, J.H., Dockery, D.W., Spiro, A. III, Speizer, F.E., Ferris, B.G., 1984. Passive smoking, gas cooking and respiratory health in children living in six cities. Am. Rev. Respir. Dis. 129, 366-374.