Package ‘powerindexR’

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Title Measuring the Power in Voting Systems

Version 1.6

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Depends R(>= 3.0.0)

Description This R package allows the determination of some distributions of the voters' power when passing laws in weighted voting situations.

License GPL-2

LazyLoad yes

Repository CRAN

NeedsCompilation no

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powerindexR-package *Measuring the Power in Voting Systems*

Description

This R package allows the determination of some distributions of the voters' power when passing laws in weighted voting situations.

Details

The DESCRIPTION file:

Package:	powerindexR
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Author:	Livino M. Armijos-Toro [aut, cre], Jose M. Alonso-Meijide [aut], Manuel A. Mosquera [aut], Alejandro
Maintainer:	Livino M. Armijos-Toro <livinoa@gmail.com>
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This R package allows the determination of some distributions of the voters' power when passing laws in weighted voting situations.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Alonso-Meijide, J. M., & Bowles, C. (2005). Generating functions for coalitional power indices: An application to the IMF. Annals of Operations Research, 137, 21-44. <https://doi.org/10.1007/s10479-005-2242-y>.

Brams, S. J., & Affuso, P. J. (1976). Power and size: A new paradox. Theory and Decision, 7(1-2), 29-56. <https://doi.org/10.1007/BF00141101>.

Colomer, J. M., & Martinez, F. (1995). The paradox of coalition trading. Journal of Theoretical Politics, 7(1), 41-63. <https://doi.org/10.1177/0951692895007001003>.

Johnston, R. J. (1978). On the measurement of power: Some reactions to Laver. Environment and Planning A, 10(8), 907-914. <https://doi.org/10.1068/a100907>.

Lucas, W. F. (1983). Measuring power in weighted voting systems (pp. 183-238). Springer New York. <https://doi.org/10.1007/978-1-4612-5430-0_9>

`MWC` *Obtain the minimal winning coalitions*

Description

This function determines the minimal winning coalitions in a weighted majority game.

Usage

```
MWC(quota, weights)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.

Value

`Number of Minimal Winning Coalitions`
: Total amount of Minimal Winning Coalitions.

`Minimal Winning Coalitions`
: Each row indicates a binary representation of each Minimal Winning Coalition.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

Examples

```
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
MWC(quota,weights)
```

`pi.banzhaf` *Power based on the Banzhaf index.*

Description

This function determines the distribution of the power based on the Banzhaf index and the Banzaf-Owen value.

Usage

```
pi.banzhaf(quota, weights, partition = NULL, normalized = FALSE, swing = FALSE)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.
`partition`	Numerical vector that indicates the partition of voters. Each component indicates the element of the partition to which such voter belongs. If it is not `NULL`, it provides the distribution of the power based on the Banzhaf-Owen value.
`normalized`	Logical option to obtain the normalized Banzhaf values.
`swing`	Logical option to obtain the number of swings of each voter.

Value

`Banzhaf value`	The Banzhaf value, if `partition=NULL`.
`Banzhaf-Owen value`	The Banzhaf-Owen value, if `partition!=NULL`.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Alonso-Meijide, J. M., & Bowles, C. (2005). Generating functions for coalitional power indices: An application to the IMF. Annals of Operations Research, 137, 21-44.

Brams, S. J., & Affuso, P. J. (1976). Power and size: A new paradox. Theory and Decision, 7(1-2), 29-56.

Examples

```
# Example Banzhaf value
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
pi.banzhaf(quota,weights)
pi.banzhaf(quota,weights,normalized=TRUE)

# Example Banzhaf-Owen value
quota<-30
weights<-c(28, 16, 5, 4, 3, 3)
# Partition={{1},{2,4,6},{3,5}}
pi.banzhaf(quota,weights,partition=c(1,2,3,2,3,2))
```

`pi.colomermartinez` *Power based on the Colomer-Martinez index.*

Description

This function determines the distribution of the power based on the Colomer-Martinez index.

Usage

```
pi.colomermartinez(quota, weights, minimal = FALSE)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.
`minimal`	Logical option to obtain the Minimal Winning Coalitions.

Value

`Colomer-Martinez`
: The Colomer-Martinez index.

`Number of Minimal Winning Coalitions`
: Total amount of Minimal Winning Coalitions.

`Minimal Winning Coalitions`
: Each row indicates a binary representation of each Minimal Winning Coalition.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Colomer, J. M., & Martinez, F. (1995). The paradox of coalition trading. Journal of Theoretical Politics, 7(1), 41-63.

Examples

```
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
pi.colomermartinez(176,weights,minimal=TRUE)
```

`pi.johnston` *Power based on the Johnston index.*

Description

This function determines the distribution of the power based on the Johnston index.

Usage

```
pi.johnston(quota, weights, quasiminimal = FALSE)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.
`quasiminimal`	Logical option to obtain the Quasi-Minimal Winning Coalitions.

Value

`Johnston` The Jonhston index.

`Number of Quasi-Minimal Winning Coalitions`
Total amount of Quasi-Minimal Winning Coalitions.

`Quasi-Minimal Winning Coalitions`
Each row indicates a binary representation of each Quasi-Minimal Winning Coalition.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Johnston, R. J. (1978). On the measurement of power: Some reactions to Laver. Environment and Planning A, 10(8), 907-914.

Examples

```
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
pi.johnston(176,weights,quasiminimal=TRUE)
```

`pi.johnstoncolomermartinez`

Power based on the Jonhston-Colomer-Martinez index.

Description

This function determines the distribution of the power based on the Jonhston-Colomer-Martinez index.

Usage

```
pi.johnstoncolomermartinez(quota, weights)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.

Value

`Jonhston-Colomer-Martinez`
The Jonhston-Colomer-Martinez index.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Colomer, J. M., & Martinez, F. (1995). The paradox of coalition trading. Journal of Theoretical Politics, 7(1), 41-63.

Johnston, R. J. (1978). On the measurement of power: Some reactions to Laver. Environment and Planning A, 10(8), 907-914.

Examples

```
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
pi.johnstoncolomermartinez(176,weights)
```

`pi.shapley` *Power based on the Shapley-Shubik index.*

Description

This function determines the distribution of the power based on the Shapley-Shubik index and the Owen value.

Usage

```
pi.shapley(quota, weights, partition = NULL)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.
`partition`	Numerical vector that indicates the partition of voters. Each component indicates the element of the partition to which such voter belongs. If it is not `NULL`, it provides the distribution of the power based on the Owen value.

Value

`Shapley value`	The Shapley value, if `partition=NULL`.
`Owen value`	The Owen value, if `partition!=NULL`.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Alonso-Meijide, J. M., & Bowles, C. (2005). Generating functions for coalitional power indices: An application to the IMF. Annals of Operations Research, 137, 21-44.

Lucas, W. F. (1983). Measuring power in weighted voting systems (pp. 183-238). Springer New York.

Examples

```
# Example Shapley value
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
pi.shapley(quota,weights)

# Example Owen value
quota<-30
```

```
weights<-c(28, 16, 5, 4, 3, 3)
# Partition={{1},{2,4,6},{3,5}}
pi.shapley(quota,weights,partition=c(1,2,3,2,3,2))
```

`powerindex` *Obtain several measures of power*

Description

This general function allows the determination of several distributions of the power under different approaches in a weighted voting situation.

Usage

```
powerindex(quota, weights, index = c("S", "B", "J", "CM", "JCM"),
partition = NULL, quasiminimal = FALSE, minimal = FALSE, normalized = FALSE,
swing = FALSE)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.
`index`	Character that indicates the used approach. `S` and `B` denote the Shapley-Shubik index and the Banzhaf index, and the Owen index and the Banzhaf-Owen index if `partition` exist. `J` is used for obtaining the Jonhston index, `CM` determines the Colomer-Martinez index and `JCM` is used for obtaining the Jonhston-Colomer-Martinez index.
`partition`	Numerical vector that indicates the partition of voters. Each component indicates the element of the partition to which such voter belongs.
`quasiminimal`	Logical option to obtain the Quasi-Minimal Winning Coalitions.
`minimal`	Logical option to obtain the Minimal Winning Coalitions.
`normalized`	Logical option to obtain the normalized Banzhaf values.
`swing`	Logical option to obtain the number of swings of each voter.

Value

See the values of the respective functions.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

References

Alonso-Meijide, J. M., & Bowles, C. (2005). Generating functions for coalitional power indices: An application to the IMF. Annals of Operations Research, 137, 21-44.

Brams, S. J., & Affuso, P. J. (1976). Power and size: A new paradox. Theory and Decision, 7(1-2), 29-56.

Colomer, J. M., & Martinez, F. (1995). The paradox of coalition trading. Journal of Theoretical Politics, 7(1), 41-63.

Johnston, R. J. (1978). On the measurement of power: Some reactions to Laver. Environment and Planning A, 10(8), 907-914.

Lucas, W. F. (1983). Measuring power in weighted voting systems (pp. 183-238). Springer New York.

Examples

```
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
powerindex(quota,weights,index="S")
powerindex(quota,weights,index="B",swing=TRUE)
powerindex(quota,weights,index="B",partition=c(1,1,2,2,3,3,4,4,4),swing=TRUE)
powerindex(quota,weights,index="J",quasiminimal=TRUE)
```

QMWC — *Obtain the quasi-minimal winning coalitions*

Description

This function determines the quasi-minimal winning coalitions in a weighted majority game.

Usage

```
QMWC(quota, weights)
```

Arguments

`quota`	Numerical value that represents the majority in a given voting.
`weights`	Numerical vector of dimension n that indicates the weights of n agents in a given voting.

Value

`Number of Quasi-Minimal Winning Coalitions`
: Total amount of Quasi-Minimal Winning Coalitions.

`Quasi-Minimal Winning Coalitions`
: Each row indicates a binary representation of each Quasi-Minimal Winning Coalition.

Author(s)

Livino M. Armijos-Toro, Jose M. Alonso-Meijide, Manuel A. Mosquera, Alejandro Saavedra-Nieves.

Examples

```
weights<-c(137,85,71,32,9,8,5,2,1)
quota<-176
QMWC(quota,weights)
```

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