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Title Measuring the Power in Voting Systems

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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

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Details

The DESCRIPTION file:

Package:	powerindexR
Type:	Package
Title:	Measuring the Power in Voting Systems
Version:	1.6
Date:	2024-05-30
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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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