# Package ‘ExactCIone’

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**Title** Admissible Exact Intervals for One-Dimensional Discrete Distributions

**Version** 1.0.5

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**Description** Construct the admissible exact intervals for the binomial proportion, the Poisson mean and the total number of subjects with a certain attribute or the total number of the subjects for the hypergeometric distribution. Both one-sided and two-sided intervals are of interest. This package can be used to calculate the intervals constructed methods developed by Wang (2014) <doi:10.5705/ss.2012.257> and Wang (2015) <doi:10.1111/biom.12360>.



**Encoding** UTF-8

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**Imports** stats

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**NeedsCompilation** no

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**Repository** CRAN

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`WbinoCI` *An Admissible Exact Confidence Interval for the Bnomial Proportion*

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## Description

An admissible exact confidence interval of level 1-alpha is constructed for the binomial proportion p. This function can be used to calculate the interval constructed method proposed by Wang (2014).

## Usage

```
WbinoCI(x, n, conf.level = 0.95, details = FALSE)
```

## Arguments

| | |
|---|---|
| `x` | the number of success or the observed data. |
| `n` | the sample size. |
| `conf.level` | Confidence level. The default is 0.95. |
| `details` | TRUE/FALSE, can be abbreviated. To choose whether to compute the confidence interval for the whole sample points and output the infimum coverage probability. The default is FALSE. |

## Details

Suppose X~bino(n,p), the sample space of X is {0,1,...,n}. Wang (2014) proposed an admissible interval which is obtained by uniformly shrinking the initial 1-alpha Clopper-Pearson interval from the middle to both sides of the sample space iteratively. This interval is admissible so that any proper sub-interval of it cannot assure the confidence coefficient. This means the interval cannot be shortened anymore.

## Value

A list which contains the confidence interval (CI) of the sample point and the confidence intervals (CIM) for all the points and the icp.

## References

Clopper, C. J. and Pearson, E. S. (1934). The use of confidence or fiducial limits in the case of the binomial. "Biometrika" 26: 404-413.

Wang, W. (2014). An iterative construction of confidence intervals for a proportion. "Statistica Sinica" 24: 1389-1410.

## Examples

```
WbinoCI(x=2,n=5,conf.level=0.95,details=TRUE)
WbinoCI(x=2,n=5,conf.level=0.95)
```

---

# WbinoCI_lower — *An Admissible Exact Lower Interval for the Binomial Proportion*

---

## Description

The 1-alpha Clopper-Pearson lower interval for the binomial proportion p.

## Usage

```
WbinoCI_lower(x, n, conf.level = 0.95, details = FALSE)
```

## Arguments

| | |
|---|---|
| `x` | the number of success or the observed data. |
| `n` | the sample size. |
| `conf.level` | Confidence level. The default is 0.95. |
| `details` | TRUE/FALSE, can be abbreviated. To choose whether to compute the confidence interval for the whole sample points. The default is FALSE. |

## Value

A list which contains the confidence interval (CI) of the sample point and the confidence intervals (CIM) for all the points.

## References

Clopper, C. J. and Pearson, E. S. (1934). The use of confidence or fiducial limits in the case of the binomial. "Biometrika" 26: 404-413.

## Examples

```
WbinoCI_lower(x=2,n=5,conf.level=0.95,details=TRUE)
WbinoCI_lower(x=2,n=5,conf.level=0.95)
```

---

WbinoCI_upper *An Admissible Exact Upper Interval for the Binomial Proportion*

---

## Description

The 1-alpha Clopper-Pearson upper interval for the binomial proportion p.

## Usage

```
WbinoCI_upper(x, n, conf.level = 0.95, details = FALSE)
```

## Arguments

| | |
|---|---|
| x | the number of success or the observed data. |
| n | the sample size. |
| conf.level | Confidence level. The default is 0.95. |
| details | TRUE/FALSE, can be abbreviated. To choose whether to compute the confidence interval for the whole sample points. The default is FALSE. |

## Value

A list which contains the confidence interval (CI) of the sample point and the confidence intervals (CIM) for all the points.

## References

Clopper, C. J. and Pearson, E. S. (1934). The use of confidence or fiducial limits in the case of the binomial. "Biometrika" 26: 404-413.

## Examples

```
WbinoCI_upper(x=2,n=5,conf.level=0.95,details=TRUE)
WbinoCI_upper(x=2,n=5,conf.level=0.95)
```

---

WhyperCI_M *An Admissible Exact Confidence Interval for M, the Number of White Balls in an Urn*

---

## Description

The confidence interval for the number of white balls in an urn that contains M white balls and N-M black balls when sampling without replacement. This function can be used to calculate the interval constructed method proposed by Wang (2015).

## Usage

```
WhyperCI_M(x, n, N, conf.level, details = FALSE)
```

## Arguments

| | |
|---|---|
| x | integer representing the number of white balls in the drawn balls. |
| n | integer representing the number of balls we draw in the urn without replacement, i.e., the sample size. |
| N | integer representing the number of all balls in an urn, i.e., the population size. |
| conf.level | the confidence level of confidence interval. |
| details | TRUE/FALSE, can be abbreviate. If choose FALSE, the confidence interval at the observed X will be returned. If choose TRUE, the confidence intervals for all sample points and the infimum coverage probability will be returned. Default is FALSE. |

## Details

Suppose X~Hyper(M,N,n). When N and n are known, Wang (2015) construct an admissible confidence interval for N by uniformly shrinking the initial 1-alpha Clopper-Pearson type interval from the mid-point of the sample space to 0. This interval is admissible so that any proper sub-interval of it cannot assure the confidence coefficient. This means the interval cannot be shortened anymore.

## Value

a list which contains i) the confidence interval for M, ii)the confidence interval for p=M/N (this interval is equal to the previous interval divided by N) and iii) the infimum coverage probability of the two intervals.

## References

Wang, W. (2015). Exact Optimal Confidence Intervals for Hypergeometric Parameters. "Journal of the American Statistical Association" 110 (512): 1491-1499.

## Examples

```
WhyperCI_M(0,50,2000,0.95,details = TRUE)
WhyperCI_M(0,50,2000,0.95)
```

---

# WhyperCI_M_lower — *An Admissible Exact One-sided Lower Interval for the Number of White Balls in Hypergeometric Distribution*

---

## Description

The 1-alpha Clopper-Pearson type lower interval for the number of white balls in an urn.

### Usage

```
WhyperCI_M_lower(X, n, N, conf.level, details = FALSE)
```

### Arguments

| | |
|---|---|
| X | integer representing the number of white balls we observed when drawn without replacement from an urn which contains both black and white balls. |
| n | the number we drawn. |
| N | integer representing the number of the whole balls in an urn. |
| conf.level | the confidence level of confidence interval. |
| details | TRUE/FALSE, can be abbreviate. Default is FALSE. If choose TRUE, the confidence intervals for the whole sample space and the icp will be returned. |

### Value

a list which contains the confidence interval.

### References

Konijn, H. S. (1973). Statistical Theory of Sample Survey Design and Analysis, Amsterdam: North-Holland.

### Examples

```
WhyperCI_M_lower(0,50,2000,0.95,details = TRUE)
WhyperCI_M_lower(0,50,2000,0.95)
```

---

## WhyperCI_M_upper — *An Admissible Exact One-sided Upper Interval for the Number of White Balls in Hypergeometric Distribution*

### Description

The 1-alpha Clopper-Pearson type upper interval for the number of white balls in an urn.

### Usage

```
WhyperCI_M_upper(X, n, N, conf.level, details = FALSE)
```

### Arguments

| | |
|---|---|
| X | integer representing the number of white balls we observed when drawn without replacement from an urn which contains both black and white balls. |
| n | the number we drawn. |
| N | integer representing the number of the whole balls in an urn. |
| conf.level | the confidence level of confidence interval. |
| details | TRUE/FALSE, can be abbreviate. Default is FALSE. If choose TRUE, the confidence intervals for the whole sample space and the icp will be returned. |

### Value

a list which contains the confidence interval.

### References

Konijn, H. S. (1973). Statistical Theory of Sample Survey Design and Analysis, Amsterdam: North-Holland.

### Examples

```
WhyperCI_M_upper(0,50,2000,0.95,details = TRUE)
WhyperCI_M_upper(0,50,2000,0.95)
```

---

## WhyperCI_N *An Admissible Exact Confidence Interval for N, the Number of Balls in an Urn.*

---

### Description

An admissible exact confidence interval for the number of balls in an urn, which is the population number of a hypergeometric distribution. This function can be used to calculate the interval constructed method proposed by Wang (2015).

### Usage

```
WhyperCI_N(x, n, M, conf.level, details = FALSE)
```

### Arguments

| | |
|---|---|
| `x` | integer representing the number of white balls in the drawn balls. |
| `n` | integer representing the number of balls we draw in the urn without replacement, i.e., the sample size. |
| `M` | the number of white balls in the urn. |
| `conf.level` | the confidence level of confidence interval. |
| `details` | TRUE/FALSE, can be abbreviate. If choose FALSE, the confidence interval at the observed X will be returned. If choose TRUE, the confidence intervals for all sample points and the infimum coverage probability will be returned. Default is FALSE. |

### Details

Suppose X~Hyper(M,N,n). When M and n are known, Wang (2015) construct an admissible confidence interval for N by uniformly shrinking the initial 1-alpha Clopper-Pearson type interval from 0 to min(M,n). This interval is admissible so that any proper sub-interval of it cannot assure the confidence coefficient. This means the interval cannot be shortened anymore.

### Value

a list which contains i) the confidence interval for N and ii) the infimum coverage probability of the intervals.

### References

Wang, W. (2015). Exact Optimal Confidence Intervals for Hypergeometric Parameters. "Journal of the American Statistical Association" 110 (512): 1491-1499.

### Examples

```
WhyperCI_N(10,50,800,0.95,details=TRUE)
WhyperCI_N(50,50,800,0.95)
```

---

## WhyperCI_N_lower — *An Admissible Exact One-sided Lower Interval for the Population Number of Hypergeometric Distribution*

---

### Description

The 1-alpha Clopper-Pearson type lower interval for the population number of hypergeometric distribution.

### Usage

```
WhyperCI_N_lower(x, n, M, conf.level, details = FALSE)
```

### Arguments

| | |
|---|---|
| x | integer representing the number of white balls we observed when drawn without replacement from an urn which contains both black and white balls. |
| n | the number we drawn. |
| M | the number of the white balls. |
| conf.level | the confidence level of confidence interval. |
| details | TRUE/FALSE, can be abbreviate. Default is FALSE. If choose TRUE, the confidence intervals for the whole sample space will be returned. |

### Value

a list which contains the confidence interval.

### References

Konijn, H. S. (1973). Statistical Theory of Sample Survey Design and Analysis, Amsterdam: North-Holland.

## Examples

```
WhyperCI_N_lower(0,50,800,0.95,details=TRUE)
WhyperCI_N_lower(0,50,800,0.95)
```

---

`WhyperCI_N_upper` *An Admissible Exact One-sided Upper Interval for the Population Number of Hypergeometric Distribution*

---

## Description

The 1-alpha Clopper-Pearson type upper interval for the population number of hypergeometric distribution.

## Usage

```
WhyperCI_N_upper(x, n, M, conf.level, details = FALSE)
```

## Arguments

| | |
|---|---|
| `x` | integer representing the number of white balls we observed when drawn without replacement from an urn which contains both black and white balls. |
| `n` | the number we drawn. |
| `M` | the number of the white balls. |
| `conf.level` | the confidence level of confidence interval. |
| `details` | TRUE/FALSE, can be abbreviate. Default is FALSE. If choose TRUE, the confidence intervals for the whole sample space will be returned. |

## Value

a list which contains the confidence interval.

## References

Konijn, H. S. (1973). Statistical Theory of Sample Survey Design and Analysis, Amsterdam: North-Holland.

## Examples

```
WhyperCI_N_upper(0,50,800,0.95,details=TRUE)
WhyperCI_N_upper(0,50,800,0.95)
```

WpoisCI *An Admissible Exact Confidence Interval for the Poisson Mean*

## Description

An admissible exact confidence interval for the Poisson mean. This function can be used to calculate the interval constructed method proposed by Wang (2014).

## Usage

```
WpoisCI(x, conf.level = 0.95, details = FALSE)
```

## Arguments

| | |
|---|---|
| `x` | the sample or the observed point. |
| `conf.level` | confidence level. The default is 0.95. |
| `details` | TRUE/FALSE, can be abbreviated. To choose whether to compute the confidence intervals for all the sample points. Default is FALSE. |

## Details

Suppose X~poi(lambda), the sample space of X is {0,1,...}. Wang (2014) proposed an admissible interval which is obtained by uniformly shrinking the initial 1-alpha Clopper-Pearson interval from 0 to the sample point of interest. This interval is admissible so that any proper sub-interval of it cannot assure the confidence coefficient. This means the interval cannot be shortened anymore.

## Value

a list which contain the confidence interval and the ICP.

## References

Wang, W. (2014). An iterative construction of confidence intervals for a proportion. "Statistica Sinica" 24: 1389-1410.

## Examples

```
WpoisCI(1)
WpoisCI(3,details = TRUE)
```

WpoisCI_lower *An Admissible Exact One-sided Lower Confidence Interval for Poisson Mean*

## Description

The 1-alpha Clopper-Pearson type lower interval for the Poisson mean.

## Usage

```
WpoisCI_lower(x, conf.level = 0.95, details = FALSE)
```

## Arguments

| | |
|---|---|
| x | the sample or the observed point. |
| conf.level | confidence level. The default is 0.95. |
| details | TRUE/FALSE, can be abbreviated. To choose whether to compute the confidence intervals for all the sample points. Default is FALSE. |

## Value

a list which contain the one-sided lower confidence interval.

## References

Garwood, F. (1936). Fiducial Limits for the Poisson Distribution. "Biometrika" 28: 437-442.

## Examples

```
WpoisCI_lower(1)
WpoisCI_lower(3,details = TRUE)
```

WpoisCI_upper *An Admissible Exact One-sided Upper Confidence Interval for Poisson Mean*

## Description

The 1-alpha Clopper-Pearson type upper interval for the Poisson mean.

## Usage

```
WpoisCI_upper(x, conf.level = 0.95, details = FALSE)
```

## Arguments

| | |
|---|---|
| `x` | the sample or the observed point. |
| `conf.level` | confidence level. The default is 0.95. |
| `details` | TRUE/FALSE, can be abbreviated. To choose whether to compute the confidence intervals for all the sample points. Default is FALSE. |

## Value

a list which contain the one-sided upper confidence interval.

## References

Garwood, F. (1936). Fiducial Limits for the Poisson Distribution. "Biometrika" 28: 437-442.

## Examples

```
WpoisCI_upper(1)
WpoisCI_upper(3,details = TRUE)
```

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