Package ‘uneqmixr’

June 7, 2022

Type Package

Title Modelling the Quantity of Material Sampled in the Risk Assessment

Version 0.0.1

Authors Mayooran Thevaraja [aut, cre], Kondaswamy Govindaraju [aut], Mark Bebbington [aut]

URL https://github.com/Mayooran1987/uneqmixr

BugReports https://github.com/Mayooran1987/uneqmixr/issues

Description This package allows general practitioners to get probability estimations and graphical displays in the risk assessment. This study mainly focuses on the risk assessment when aggregating unequal incremental samples in the production process.

License GPL (>= 2)

Encoding UTF-8

LazyData true

Imports extraDistr, ggplot2, ggthemes, reshape2, stats

Suggests spelling,
testthat

RoxygenNote 7.2.0

Depends R (>= 4.0)

Maintainer Mayooran Thevaraja <mayooran@eng.jfn.ac.lk>

Language en-US

R topics documented:

`AOQL_scenarios` *Construction of AOQ curve and calculate AOQL value based on average microbial counts*

Description

`AOQL_scenarios` provides the Average Outgoing Quality (AOQ) curve and calculates Average Outgoing Quality Level (AOQL) value based on expected microbial counts in each scenario.

Usage

```
AOQL_scenarios(c,llim, sd, m, n, scenario, K, n_sim)
```

Arguments

`c`	acceptance number
`llim`	the upper limit for graphing the arithmetic mean of cell count
`sd`	standard deviation on the log10 scale (default value 0.8).
`m`	the vector of incremental samples (with equal/unequal weights).
`n`	number of aggregate samples which are used for inspection.
`scenario`	what scenario we have considered such as `"1B"`or `"2"`or `"3"`
`K`	dispersion parameter of the Poisson gamma distribution (default value 0.25)
`n_sim`	number of simulations (large simulations provide more precise estimation).

Details

Since P_a is the probability of acceptance, λ is the arithmetic mean of cell count and the outgoing contaminated arithmetic mean of cell count of incremental samples is given by AOQ as the product λP_a. The quantity $AOQL$ is defined as the maximum proportion of outgoing contaminated incremental samples and is given by

$$AOQL = \max_{\lambda \geq 0} \lambda P_a$$

Value

AOQ curve and AOQL value based on expected microbial counts in each scenario.

See Also

scenario_1B_pa, scenario_2_pa,scenario_3_pa

Examples

```
c <- 0
llim <- 0.5
sd <- 0.8
m1 <- c(10,10,10,10,10,10)
m2 <- c(10,12,18,20)
n <- 10
scenario <- "1B"
n_sim <- 100000
AOQL_scenarios(c,llim, sd, m=m1, n, scenario, K, n_sim)
AOQL_scenarios(c,llim, sd, m=m2, n, scenario, K, n_sim)
```

---

scenario_1A_OC — *Construction of Operating Characteristic (OC) curve under lot with homogeneous contaminations.*

Description

scenario_1A_OC provides the Operating Characteristic (OC) curves under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_1A_OC(c, mulow, muhigh, sd, M, m1, n)
```

Arguments

c	acceptance number
mulow	the lower value of the mean concentration (μ) for use in the graphical display's x-axis.
muhigh	the upper value of the mean concentration (μ) for use in the graphical display's x-axis.
sd	standard deviation on the log10 scale (default value 0.8).
M	the quantity (weight) of the aggregate sample.
m1	the quantity (weight) of the based sample for the risk assessment (for this research, we used a quantity of sample which is to be the minimum quantity of selected incremental samples).
n	number of aggregate samples which are used for inspection.

Details

scenario_1A_OC provides the Operating Characteristic (OC) curves under scenario 1 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (lot with homogeneous contaminations), we employed Poisson distribution to the model number of micro-organisms in the incremental samples. The purpose of this function used for compares different sets of sampling schemes when lot with heterogeneous and high-level contamination. Under this scenario expected cell count in each incremental sample can be written in terms of the based incremental sample's expected cell count (for this study, the based sample is a sample that is to be the minimum quantity). The probability of acceptance is plotted against mean log10 concentration and expected cell counts. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu+log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Operating Characteristic (OC) curves under lot with homogeneous contaminations.

See Also

scenario_1A_pd

Examples

```
c <- 0
mulow <- -6
muhigh <- 0
sd <- 0.8
M <- 60
m1 <- c(5,10,15)
n <- 10
scenario_1A_OC(c, mulow, muhigh, sd, M, m1, n)
```

`scenario_1A_pa` *Probability of acceptance estimation when lot with homogeneous contaminations.*

Description

`scenario_1A_pa` provides a probability of acceptance under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_1A_pa(c,lambda, M, m1, n)
```

Arguments

`c`	acceptance number
`lambda`	expected cell count in the based sample (for this research, we used a quantity of sample which is to be the minimum quantity of selected incremental samples).
`M`	the quantity (weight) of the aggregate sample.
`m1`	the quantity (weight) of the based sample for the risk assessment.
`n`	number of aggregate samples which are used for inspection.

Details

`scenario_1A_pa` provides a probability of acceptance under scenario 1 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with homogeneous contaminations), we employed Poisson distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu+log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of acceptance under lot with homogeneous contaminations.

Examples

```
c <- 0
lambda <- 0.05
M <- 60
m1 <- 5
n <- 10
scenario_1A_pa(c,lambda, M, m1, n)
```

`scenario_1A_pd` *Probability of detection estimation when lot with homogeneous contaminations.*

Description

scenario_1A_pd provides a probability of detection under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_1A_pd(lambda, M, m1)
```

Arguments

lambda	expected cell count in the based sample (for this research, we used a quantity of sample which is to be the minimum quantity of selected incremental samples).
M	the quantity (weight) of the aggregate sample.
m1	the quantity (weight) of the based sample for the risk assessment.

Details

scenario_1A_pd provides a probability of detection under scenario 1 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with homogeneous contaminations), we employed Poisson distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of detection under lot with homogeneous contaminations.

Examples

```
lambda <- 0.05
M <- 60
m1 <- 5
scenario_1A_pd(lambda, M, m1)
```

scenario_1B_OC *Construction of Operating Characteristic (OC) curve under lot with homogeneous contaminations based on simulations results.*

Description

scenario_1B_OC provides the Operating Characteristic (OC) curves under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_1B_OC(c, mulow, muhigh, sd, m1, m2, n, n_sim)
```

Arguments

c	acceptance number
mulow	the lower value of the mean concentration (μ) for use in the graphical display's x-axis.
muhigh	the upper value of the mean concentration (μ) for use in the graphical display's x-axis.
sd	standard deviation on the log10 scale (default value 0.8).
m1	the vector of the first set of incremental samples (with equal/unequal weights).
m2	the vector of the second set of incremental samples (with equal/unequal weights).
n	number of aggregate samples which are used for inspection.
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_1B_OC provides the Operating Characteristic (OC) curves under scenario 2 of modelling the quantity of material sampled in the risk assessment study. The purpose of this function used for compares two different sets of sampling schemes when lot with homogeneous contaminations. Nevertheless, each sampling scheme's total quantity (weight of aggregate sample (say M)) must be equal. The probability of acceptance is plotted against mean log10 concentration and expected cell counts. We employed Poisson distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu+log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Operating Characteristic (OC) curves when lot with homogeneous contaminations.

See Also

scenario_1B_pd

Examples

```
c <- 0
mulow <- -6
muhigh <- 0
sd <- 0.8
m1 <- c(10,10,10,10,10,10)
m2 <- c(10,12,18,20)
n <- 10
n_sim <- 100000
scenario_1B_OC(c, mulow, muhigh, sd, m1, m2, n, n_sim)
```

`scenario_1B_pa` *Probability of acceptance estimation when lot with homogeneous contaminations based on simulations.*

Description

`scenario_1B_pa` provides a probability of acceptance under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_1B_pa(c, mu, sd, m, n, n_sim)
```

Arguments

`c`	acceptance number
`mu`	the the mean concentration (μ).
`sd`	standard deviation on the log10 scale (default value 0.8).
`m`	the vector of incremental samples (with equal/unequal weights).
`n`	number of aggregate samples which are used for inspection.
`n_sim`	number of simulations (large simulations provide more precise estimation).

Details

`scenario_1B_pa` provides a probability of acceptance under scenario 1 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (lot with homogeneous contaminations), we employed Poisson distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of acceptance when lot with homogeneous contaminants by simulations results.

Examples

```
c <- 0
mu <- -3
sd <- 0.8
m <- c(5,10,15,5,10,10,5)
n <- 10
n_sim <- 100000
scenario_1B_pa(c, mu, sd, m, n, n_sim)
```

---

scenario_1B_pd *Probability of detection estimation when lot with homogeneous contaminations based on simulations.*

Description

scenario_1B_pd provides a probability of detection under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_1B_pd(mu, sd, m, n_sim)
```

Arguments

mu	the the mean concentration (μ).
sd	standard deviation on the log10 scale (default value 0.8).
m	the vector of incremental samples (with equal/unequal weights).
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_1B_pd provides a probability of detection under scenario 1 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (lot with homogeneous contaminations), we employed Poisson distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of detection when lot with homogeneous contaminants by simulations results.

Examples

```
mu <- -3
sd <- 0.8
m <- c(5,10,15,5,10,10,5)
n_sim <- 100000
scenario_1B_pd(mu, sd, m, n_sim)
```

`scenario_2_OC` *Construction of Operating Characteristic (OC) curve under lot with heterogeneous and high-level contamination.*

Description

`scenario_2_OC` provides the Operating Characteristic (OC) curves under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_2_OC(c, mulow, muhigh, sd, m1, m2, n, n_sim)
```

Arguments

`c`	acceptance number
`mulow`	the lower value of the mean concentration (μ) for use in the graphical display's x-axis.
`muhigh`	the upper value of the mean concentration (μ) for use in the graphical display's x-axis.
`sd`	standard deviation on the log10 scale (default value 0.8).
`m1`	the vector of the first set of incremental samples (with equal/unequal weights).
`m2`	the vector of the second set of incremental samples (with equal/unequal weights).
`n`	number of aggregate samples which are used for inspection.
`n_sim`	number of simulations (large simulations provide more precise estimation).

Details

`scenario_2_OC` provides the Operating Characteristic (OC) curves under scenario 1 of modelling the quantity of material sampled in the risk assessment study. The purpose of this function used for compares two different sets of sampling schemes when lot with heterogeneous and high-level contamination. Nevertheless, each sampling scheme's total quantity (weight of aggregate sample (say M)) must be equal. The probability of acceptance is plotted against mean log10 concentration and expected cell counts. We employed Poisson lognormal distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu+log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Operating Characteristic (OC) curves when lot with heterogeneous and high-level contamination.

See Also

scenario_2_pd

Examples

```
c <- 0
mulow <- -10
muhigh <- 0
sd <- 0.8
m1 <- c(10,10,10,10,10,10)
m2 <- c(10,12,18,20)
n <- 10
n_sim <- 100000
scenario_2_OC(c, mulow, muhigh, sd, m1, m2, n, n_sim)
```

---

scenario_2_pa *Probability of acceptance estimation when lot with heterogeneous and high-level contamination.*

Description

scenario_2_pa provides a probability of acceptance under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_2_pa(c, mu, sd, m, n, n_sim)
```

Arguments

c	acceptance number
mu	the the mean concentration (μ).
sd	standard deviation on the log10 scale (default value 0.8).
m	the vector of incremental samples (with equal/unequal weights).
n	number of aggregate samples which are used for inspection.
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_2_pa provides a probability of acceptance under scenario 2 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with heterogeneous, high-level contamination), we employed Poisson lognormal distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of acceptance when lot with heterogeneous and high-level contamination.

Examples

```
c <- 0
mu <- -3
sd <- 0.8
m <- c(5,10,15,5,10,10,5)
n <- 10
n_sim <- 100000
scenario_2_pa(c, mu, sd, m, n, n_sim)
```

`scenario_2_pd` *Probability of detection estimation when lot with heterogeneous and high-level contamination.*

Description

scenario_2_pd provides a probability of detection under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_2_pd(mu, sd, m, n_sim)
```

Arguments

mu	the the mean concentration (μ).
sd	standard deviation on the log10 scale (default value 0.8).
m	the vector of incremental samples (with equal/unequal weights).
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_2_pd provides a probability of detection under scenario 2 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with heterogeneous, high-level contamination), we employed Poisson lognormal distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of detection when lot with heterogeneous and high-level contamination.

Examples

```
mu <- -3
sd <- 0.8
m <- c(5,10,15,5,10,10,5)
n_sim <- 100000
scenario_2_pd(mu, sd, m, n_sim)
```

`scenario_3_OC` *Construction of Operating Characteristic (OC) curve under lot with heterogeneous and low-level contamination.*

Description

`scenario_3_OC` provides the Operating Characteristic (OC) curves under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_3_OC(c, mulow, muhigh, sd, m1, m2, K, n, n_sim)
```

Arguments

`c`	acceptance number
`mulow`	the lower value of the mean concentration (μ) for use in the graphical display's x-axis.
`muhigh`	the upper value of the mean concentration (μ) for use in the graphical display's x-axis.
`sd`	standard deviation on the log10 scale (default value 0.8).
`m1`	the vector of the first set of incremental samples (with equal/unequal weights).
`m2`	the vector of the second set of incremental samples (with equal/unequal weights).
`K`	shape parameter (default value 0.25).
`n`	number of aggregate samples which are used for inspection.
`n_sim`	number of simulations (large simulations provide more precise estimation).

Details

`scenario_3_OC` provides the Operating Characteristic (OC) curves under scenario 2 of modelling the quantity of material sampled in the risk assessment study. The purpose of this function used for compares two different sets of sampling schemes when lot with heterogeneous and low-level contamination. Nevertheless, each sampling scheme's total quantity (weight of aggregate sample (say M)) must be equal. We employed Poisson gamma distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Operating Characteristic (OC) curves when lot with heterogeneous and low-level contamination.

See Also

scenario_3_pd

Examples

```
c <- 0
mulow <- -5
muhigh <- 2
sd <- 0.8
m1 <- c(10,10,10,10,10,10)
m2 <- c(10,12,18,20)
K <- 0.05
n <- 10
n_sim <- 100000
scenario_3_OC(c, mulow, muhigh, sd, m1, m2, K, n, n_sim)
```

---

scenario_3_pa	*Probability of acceptance estimation when lot with heterogeneous and low-level contamination.*

Description

scenario_3_pa provides a probability of acceptance under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_3_pa(c, mu, sd, m, n, K, n_sim)
```

Arguments

c	acceptance number
mu	the the mean concentration (μ).
sd	standard deviation on the log10 scale (default value 0.8).
m	the vector of incremental samples (with equal/unequal weights).
n	number of aggregate samples which are used for inspection.
K	shape parameter (default value 0.25).
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_3_pa provides a probability of acceptance under scenario 2 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with heterogeneous, low-level contamination), we employed Poisson gamma distribution to the model number of micro-organisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu + log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of acceptance when lot with heterogeneous and low-level contamination.

Examples

```
c <- 0
mu <- -3
sd <- 0.8
m <- c(5,10,15,5,10,10,5)
n <- 10
K <- 0.25
n_sim <- 100000
scenario_3_pa(c, mu, sd, m, n, K, n_sim)
```

---

scenario_3_pd *Probability of detection estimation when lot with heterogeneous and low-level contamination.*

Description

scenario_3_pd provides a probability of detection under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
scenario_3_pd(mu, sd, m, K, n_sim)
```

Arguments

mu	the the mean concentration (μ).
sd	standard deviation on the log10 scale (default value 0.8).
m	the vector of incremental samples(with equal/unequal weights).
K	shape parameter (default value 0.25).
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_3_pd provides a probability of detection under scenario 2 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with heterogeneous, low-level contamination), we employed Poisson gamma distribution to the model number of microorganisms in the incremental samples. Based on the food safety literature, the expected cell count is given by $\lambda = 10^{\mu+log(10)\sigma^2/2}$. (this section will be updated later on)

Value

Probability of detection when lot with heterogeneous and low-level contamination.

Examples

```
mu <- -3
sd <- 0.8
m <- c(5,10,15,5,10,10,5)
K <- 0.05
n_sim <- 100000
scenario_3_pd(mu, sd, m, K, n_sim)
```

Index