

Package ‘uneqmixr’

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Type Package

Title Modelling the Quantity of Material Sampled in the Risk Assessment

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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

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AOQL_scenarios	<i>Construction of AOQ curve and calculate AOQL value based on average microbial counts</i>
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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, scenario, n, type, 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).
scenario	what scenario we have considered such as "1" or "2" or "3"
n	number of aggregate samples which are used for inspection.
type	what type of the results you would like to consider such as "theory" or "simulation".
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_1_pa](#), [scenario_2_pa](#), [scenario_3_pa](#)

Examples

```
c <- 0  
llim <- 0.02  
sd <- 0.8  
m1 <- c(5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5)  
m2 <- c(10,15,15,20,20,15,15,15,15,20,10,10,20,20,10,20,10,15,15,20,20,15,  
15,15,15,20,10,10,20,20,10,20)  
scenario <- "1"  
n <- 10  
AOQL_scenarios(c,llim, sd, m = m1, scenario, n, type = "theory")  
AOQL_scenarios(c,llim, sd, m = m2, scenario, n, type = "theory")
```

compare_ex_var_scenario_1

Graphical displays of expectation or variance of different sampling schemes under scenario 1.

Description

`compare_ex_var_scenario_1` provides graphical displays based on expectation or variance under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
compare_ex_var_scenario_1(mulow, muhigh, sd, m1, m2, measure)
```

Arguments

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).
measure	what type of measure you would like to consider for the graph, such as "expectation" or "variance".

Details

`compare_ex_var_scenario_1` provides graphical displays based on expectation or variance 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. (this section will be updated later on)

Value

Graphical displays based on expectation or variance under lot with homogeneous contaminations.

Examples

```
mulow <- 0  
muhigh <- 2  
m1 <- c(5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5)  
m2 <- c(10,15,15,20,20,15,15,15,15,20,10,10,20,20,10,20,10,15,15,20,20,15,  
15,15,15,20,10,10,20,20,10,20)  
compare_ex_var_scenario_2(mulow, muhigh, sd = 0.8, m1, m2, measure = "variance")  
compare_ex_var_scenario_2(mulow, muhigh, sd = 0.8, m1, m2, measure = "expectation")
```

compare_ex_var_scenario_3

Graphical displays of expectation or variance of different sampling schemes under scenario 3.

Description

`compare_ex_var_scenario_3` provides graphical displays based on expectation or variance under scenario 3 of modelling the quantity of material sampled in the risk assessment study.

Usage

```
compare_ex_var_scenario_3(mulow, muhigh, sd, m1, m2, K, measure)
```

Arguments

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).
measure	what type of measure you would like to consider for the graph, such as "expectation" or "variance".

Details

`compare_ex_var_scenario_3` provides a probability of acceptance under scenario 3 of modelling the quantity of material sampled in the risk assessment study. Under this scenario (a lot with homogeneous contaminations), 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

Graphical displays based on expectation or variance when lot with heterogeneous and low-level contamination.

```
muloow <- 0  
muhigh <- 2  
m1 <- c(5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
        5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
        5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5)  
m2 <- c(10,15,15,20,20,15,15,15,15,20,10,10,20,20,10,20,10,15,15,20,20,15,  
        15,15,15,20,10,10,20,20,10,20)  
K <- 0.05  
compare_ex_var_scenario_3(muloow, muhigh, sd = 0.8, m1, m2, K, measure = "variance")  
compare_ex_var_scenario_3(muloow, muhigh, sd = 0.8, m1, m2, K, measure = "expectation")
```

scenario_1_0C	<i>Construction of Operating Characteristic (OC) curve under lot with homogeneous contaminations based on simulations results.</i>
---------------	--

scenario_1_OC provides the Operating Characteristic (OC) curves under scenario 2 of modelling the quantity of material sampled in the risk assessment study.

```
scenario_1_OC(c, mulow, muhigh, sd, m1, m2, n, type, n_sim)
```

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.
type	what type of the results you would like to consider such as "theory" or "simulation".
n_sim	number of simulations (large simulations provide more precise estimation).

scenario_1_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)

Probability of acceptance under lot with homogeneous contaminations.

```
c <- 0  
mu <- -3  
sd <- 0.8  
m <- c(5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
        5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
        5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5)  
n <- 10  
scenario_1_pa(c, mu, sd = 0.8, m, n, type = "theory")  
scenario_1_pa(c, mu, sd = 0.8, m, n, type = "simulation", n_sim = 1000000)
```

scenario_1_pd	<i>Probability of detection estimation when lot with homogeneous contaminations based on simulations.</i>
---------------	---

`scenario_1_pd` provides a probability of detection under scenario 1 of modelling the quantity of material sampled in the risk assessment study.

```
scenario_1_pd(mu, sd, m, type, n_sim)
```

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).
type	what type of the results you would like to consider such as "theory" or "simulation".
n_sim	number of simulations (large simulations provide more precise estimation).

`scenario_1_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)

Probability of detection when lot with homogeneous contaminants by using theoretical or simulations based results.

Examples

```
mu <- -3  
sd <- 0.8  
m <- c(5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5)  
scenario_1_pd(mu, sd = 0.8, m, type = "theory")  
scenario_1_pd(mu, sd = 0.8, m, type = "simulation", n_sim = 1000000)
```

scenario_2_0C	<i>Construction of Operating Characteristic (OC) curve under lot with heterogeneous and high-level contamination.</i>
---------------	---

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, type, 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.
type	what type of the results you would like to consider such as "theory" or "simulation".
n_sim	number of simulations (large simulations provide more precise estimation).

Details

scenario_2_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 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)

Probability of detection when lot with heterogeneous and high-level contamination by using theoretical or simulations based results.

```
mu <- -3  
sd <- 0.8  
m <- c(5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,  
5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5,5)  
scenario_2_pd(mu, sd = 0.8, m, type = "theory")  
scenario_2_pd(mu, sd = 0.8, m, type = "simulation", n_sim = 1000000)
```

scenario_3_0C	<i>Construction of Operating Characteristic (OC) curve under lot with heterogeneous and low-level contamination.</i>
---------------	--

scenario_3_OC provides the Operating Characteristic (OC) curves under scenario 3 of modelling the quantity of material sampled in the risk assessment study.

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

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.
type	what type of the results you would like to consider such as "theory" or "simulation".
n_sim	number of simulations (large simulations provide more precise estimation).

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