Package 'RM2'

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Title Revenue Management and Pricing Package

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Depends R (>= 2.7.1), msm

Description RM2 is a simple package that implements functions used in revenue management and pricing environments.

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R topics documented:

EM *Unconstrain the demand using the Expectation-Maximization algorithm*

Description

EM unconstrains demand data in quantity-based revenue management.

Usage

```
EM(demand = demand, eps = 0.005)
```

Arguments

demand	demand vector with constrained and unconstrained entries. A 0 in the name of an entry means that the corresponding demand is unconstrained. Conversely, a 1 in the name of an entry suggests that the corresponding demand is constrained.
eps	small number used as the stopping criterion. The default value is 0.005.

Details

EM unconstrains demand data in quantity-based revenue management. The observed demand entries, some of which are constrained because the product class was closed, are assumed to be realizations from an underlying normal distribution with mean μ and standard deviation σ. The objective is to find the parameters μ and σ of this underlying demand distribution.

Value

param	parameters of demand distribution
niter	number of iterations
demand	unconstrained demand vector
history	parameter convergence history

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References

Talluri, K. T. and Van Ryzin, G. (2004) *The Theory and Practice of Revenue Management*. New York, NY: Springer Science + Business Media, Inc. (Pages 474–477).

Examples

```
# SPECIFY THE SEED
set.seed(333)
# SPECIFY REAL PARAMETERS OF THE DEMAND DISTRIBUTION
rmean <- 20
rsd <- 4
nrn <- 20
# GENERATE REAL DEMAND
rdemand <- round(rnorm(nrn, rmean, rsd))
# GENERATE BOOKING LIMITS
bl <- round(rnorm(nrn, rmean, rsd))
# GENERATE OBSERVED DEMAND
demand <- rdemand * (rdemand <= bl) + bl * (rdemand > bl)
# IDENTIFIED PERIODS WITH CONSTRAINED DEMAND: 1 - CONSTRAINED DEMAND
names(demand) <- as.character(as.numeric(rdemand>bl))
demand
# UNTRUNCATE DEMAND
EM(demand)
EM(demand, eps=0.005)
EM(demand, eps=0.00005)
# MODIFY DEMAND VECTOR - NO CONSTRAINED INSTANCES ARE OBSERVED
names(demand) <- rep(0, length(demand))
# ATTEMPT TO UNTRUNCATE THE DEMAND
EM(demand, eps=0.005)
```

EMSRb *Perform EMSR-b with Buy-up Heuristic for the Single-Resource Problem*

Description

`EMSRb` heuristic sets the protection levels for multiple fare classes.

Usage

```
EMSRb(Fare = Fare, Mean = Mean, Var = Var, p_up = numeric(length(Fare)), cap = cap)
```

Arguments

`Fare`	revenue vector associated with selling the offered products
`Mean`	mean product demand
`Var`	product demand variance
`p_up`	buy-up probabilities. The default entails no buy-up probabilities.
`cap`	available capacity

Details

`EMSRb` sorts internally the `Fare` vector together with all other input vectors in descending order of the revenues. If `p_up` is missing, `EMSRb` performs the classical EMSRb heuristic.

Value

p	protection levels

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Examples

```
## Run a simple EMRSb instance
Fare <- c(150, 100, 50, 250)
Mean <- c(75, 125, 500, 50)
Var <- c(75, 125, 500, 50)
cap <- 400
p <- EMSRb(Fare = Fare, Mean = Mean, Var = Var, cap = cap)
p
```

PD *Unconstrain the demand using the Projection-Detruncation algorithm*

Description

PD unconstrains demand data in quantity-based revenue management.

Usage

```
PD(demand = demand, tau = 0.5, eps = 0.005)
```

Arguments

demand	demand vector with constrained and unconstrained entries. A 0 in the name of an entry means that the corresponding demand is unconstrained. Conversely, a 1 in the name of an entry suggests that the corresponding demand is constrained.
tau	fixed constant that reflects how aggresive the unconstrainig is. The default value is 0.5.
eps	small number used as the stopping criterion. The default value is 0.005.

Details

PD unconstrains demand data in quantity-based revenue management. The observed demand entries, some of which are constrained because the product class was closed, are assumed to be realizations from an underlying normal distribution with mean μ and standard deviation σ. The objective is to find the parameters μ and σ of this underlying demand distribution.

Value

`param`	parameters of demand distribution
`niter`	number of iterations
`demand`	unconstrained demand vector
`history`	parameter convergence history

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References

Talluri, K. T. and Van Ryzin, G. (2004) *The Theory and Practice of Revenue Management*. New York, NY: Springer Science + Business Media, Inc. (Pages 485–486).

Examples

```
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set.seed(333)
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rmean <- 20
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# GENERATE REAL DEMAND
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# GENERATE BOOKING LIMITS
bl <- round(rnorm(nrn, rmean, rsd))
# GENERATE OBSERVED DEMAND
demand <- rdemand * (rdemand <= bl) + bl * (rdemand > bl)
# IDENTIFIED PERIODS WITH CONSTRAINED DEMAND: 1 - CONSTRAINED DEMAND
names(demand) <- as.character(as.numeric(rdemand>bl))
demand
# UNTRUNCATE DEMAND
PD(demand)
PD(demand, tau=0.5, eps=0.005)
PD(demand, tau=0.5, eps=0.00005)
# MODIFY DEMAND VECTOR - NO CONSTRAINED INSTANCES ARE OBSERVED
names(demand) <- rep(0, length(demand))
# ATTEMPT TO UNTRUNCATE THE DEMAND
PD(demand, tau=0.5, eps=0.005)
```

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