Package 'RM2'

February 19, 2015

Version 0.0

Date 2008-07-16

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.

License GPL (>= 3)

Repository CRAN

Date/Publication 2008-08-13 14:37:36

NeedsCompilation no

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

Author(s)

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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 Prob-*
                               lem

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

Author(s)

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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

```
# 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
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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