Package 'arqas'

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Type Package

Title Aplication in R for Queueing Analisis and Simulation

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Depends R (>= 1.8.0), distr, reshape, ggplot2

Suggests testthat

Description This package implements the main characteristics of the following queueing models: M/M/1, M/M/s, M/M/1/k, M/M/s/k, M/M/1/Inf/H, M/M/s/Inf/H, M/M/s/Inf/H with Y replacements, M/M/Inf, Open Jackson Networks and Closed Jackson Networks.
Moreover, it is also possible to simulate similar queueing models with any type of arrival or service distribution: G/G/1, G/G/s, G/G/1/k, G/G/s/k, G/G/1/Inf/H, G/G/s/Inf/H, G/G/s/Inf/H with Y replacements, Open Networks and Closed Networks.

License GPL (>= 2)

LazyData yes

R topics documented:

`ClosedJacksonNetwork` *Obtains the main characteristics of a Closed Jackson Network model*

Description

Obtains the main characteristics of a Closed Jackson Network model

Usage

```
ClosedJacksonNetwork(mu = c(5, 5, 10, 15),
  s = c(2, 2, 1, 1),
  p = array(c(0.25, 0.15, 0.5, 0.4, 0.15, 0.35, 0.25, 0.3, 0.2, 0.2, 0.15, 0.25, 0.4, 0.3, 0.1
  n = 3)
```

Arguments

`mu`	Vector of mean service rates
`s`	Vector of servers at each node
`p`	Routing matrix, where p_{ij} is the routing probability from node i to node j
`n`	Number of customers in the network

Value

Returns the next information of a Closed Jackson Network model:

rho	Traffic intensity ρ
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: M_M_1, M_M_1_INF_H, M_M_1_K, M_M_INF, M_M_S, M_M_S_INF_H, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

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`ClosedNetwork` *Obtains the main characteristics of a Closed Network model by simulation*

Description

Obtains the main characteristics of a Closed Network model by simulation

Usage

```
ClosedNetwork(serv.distr, s, p, staClients, nClients,
  transitions, historic = FALSE)
```

Arguments

serv.distr	Service distributions for the nodes of the network
s	Vector of servers at each node
p	Routing matrix, where p_{ij} is the routing probability from node i to node j
staClients	Number of customers used in the stabilization stage
nClients	Number of customers in the system
transitions	Number of transitions between nodes used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a Closed Network model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Vector of expected number of customers in the nodes L
lq	Vector of expected number of customers in the queues of the nodes L_q
lqt	Expected number of customers in the all queues
w	Vector of expected waiting times in the nodes W

wq	Vector of expected waiting times in the queues of the nodes W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation.

See Also

Other SimulatedModels: G_G_1, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

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exportToUI *Exports a function to the UI*

Description

Exports a function to the UI

Usage

```
exportToUI(fun, name, types, class)
```

Arguments

fun	Function of the model
name	Name of the model
types	Type of each parameter of the function (numerical, character, vector, matrix)
class	A string to agrupate funtions in the same menu option

FW *Distribution function of the waiting time in the system*

Description

Returns the value of the cumulative distribution function of the waiting time in the system for a queueing model

$$W(x) = P(W \leq x)$$

Usage

```
FW(qm, x)

## S3 method for class 'MarkovianModel'
FW(qm, x)

## S3 method for class 'M_M_1'
FW(qm, x)

## S3 method for class 'M_M_S'
FW(qm, x)

## S3 method for class 'M_M_1_K'
FW(qm, x)

## S3 method for class 'M_M_S_K'
FW(qm, x)

## S3 method for class 'M_M_1_INF_H'
FW(qm, x)

## S3 method for class 'M_M_S_INF_H'
FW(qm, x)

## S3 method for class 'M_M_S_INF_H_Y'
FW(qm, x)

## S3 method for class 'M_M_INF'
FW(qm, x)
```

Arguments

qm	Queueing model
x	Time

Details

FW.MarkovianModel implements the default method (generates a message)

FW.M_M_1 implements the method for a M/M/1 queueing model

FW.M_M_S implements the method for a M/M/S queueing model

FW.M_M_1_K implements the method for a M/M/1/K queueing model

FW.M_M_S_K implements the method for a M/M/S/K queueing model

FW.M_M_1_INF_H implements the method for a M/M/1/∞/H queueing model

FW.M_M_S_INF_H implements the method for a M/M/s/∞/H queueing model

FW.M_M_S_INF_H_Y implements the method for a M/M/s/∞/H/ with Y replacements queueing model

FW.M_M_INF implements the method for a M/M/∞ queueing model

Value

$$W(x)$$

FWq *Distribution function of the waiting time in the queue*

Description

Returns the value of the cumulative distribution function of waiting time in the queue

$$W_q = P(W_q \leq x)$$

Usage

```
FWq(qm, x)

## S3 method for class 'MarkovianModel'
FWq(qm, x)

## S3 method for class 'M_M_1'
FWq(qm, x)

## S3 method for class 'M_M_S'
FWq(qm, x)

## S3 method for class 'M_M_1_K'
FWq(qm, x)

## S3 method for class 'M_M_S_K'
FWq(qm, x)

## S3 method for class 'M_M_1_INF_H'
FWq(qm, x)

## S3 method for class 'M_M_S_INF_H'
FWq(qm, x)

## S3 method for class 'M_M_S_INF_H_Y'
FWq(qm, x)

## S3 method for class 'M_M_INF'
FWq(qm, x)
```

Arguments

qm	Queueing model
x	Time

Details

`FWq.MarkovianModel` implements the default method (generates a message)

`FWq.M_M_1` implements the method for a M/M/1 queueing model

`FWq.M_M_S` implements the method for a M/M/S queueing model

`FWq.M_M_1_K` implements the method for a M/M/1/K queueing model

`FWq.M_M_S_K` implements the method for a M/M/S/K queueing model

`FWq.M_M_1_INF_H` implements the method for a M/M/1/∞/H queueing model

`FWq.M_M_S_INF_H` implements the method for a M/M/s/∞/H queueing model

`FWq.M_M_S_INF_H_Y` implements the method for a M/M/s/∞/H with Y replacements queueing model

`FWq.M_M_INF` implements the method for a M/M/∞ queueing model

Value

$$W_q(x)$$

`G_G_1` *Obtains the main characteristics of a G/G/1 model by simulation*

Description

Obtains the main characteristics of a G/G/1 model by simulation

Usage

```
G_G_1(arr.distr = Exp(1), serv.distr = Exp(1),
  staClients = 100, nClients = 1000, historic = FALSE)
```

Arguments

`arr.distr`	Arrival distribution
`serv.distr`	Service distribution
`staClients`	Number of customers used in the stabilization stage
`nClients`	Number of customers used in the simulation stage
`historic`	Parameter used to activate/deactivate the historic information

Value

Returns the next information of a G/G/1 model:

`pn`	Stores all the positives steady-state probabilities of having n customers, with n from 0 to staClients+nClients
`l`	Expected number of customers in the system L
`lq`	Expected number of customers in the queue L_q
`w`	Expected waiting time in the system W

wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

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G_G_1_INF_H *Obtains the main characteristics of a G/G/1/∞/H model by simulation*

Description

Obtains the main characteristics of a G/G/1/∞/H model by simulation

Usage

```
G_G_1_INF_H(arr.distr = Exp(1), serv.distr = Exp(1),
  H = 2, staClients = nClients * 0.5, nClients = 1000,
  historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
H	Population size
staClients	Number of customers used in the stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a G/G/1/∞/H model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

G_G_1_K *Obtains the main characteristics of a G/G/1/K model by simulation*

Description

Obtains the main characteristics of a G/G/1/K model by simulation

Usage

```
G_G_1_K(arr.distr = Exp(1), serv.distr = Exp(1), K = 2,
  staClients = 100, nClients = 1000, historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
K	Maximun size of the queue
staClients	Number of customers used in the stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a G/G/1/K model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation.

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

G_G_INF *Obtains the main characteristics of a G/G/∞ model by simulation*

Description

Obtains the main characteristics of a G/G/∞ model by simulation

Usage

```
G_G_INF(arr.distr = Exp(1), serv.distr = Exp(1),
  staClients = 100, nClients = 1000, historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
staClients	Number of customers used in stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a G/G/∞ model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_1_K, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

G_G_S *Obtains the main characteristics of a G/G/s model by simulation*

Description

Obtains the main characteristics of a G/G/s model by simulation

Usage

```
G_G_S(arr.distr = Exp(1), serv.distr = Exp(1), s = 2,
  staClients = 100, nClients = 1000, historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
s	Number of servers
staClients	Number of customers used in the stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter used to activate/deactivate the historic information

Value

Returns the next information of a G/G/S model:

pn	vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

G_G_S_INF_H *Obtains the main characteristics of a G/G/S/∞/H model by simulation*

Description

Obtains the main characteristics of a G/G/S/∞/H model by simulation

Usage

```
G_G_S_INF_H(arr.distr = Exp(1), serv.distr = Exp(1),
  s = 2, H = 2, staClients = 100, nClients = 1000,
  historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
s	Number of servers
H	Population size
staClients	Number of customers used in the stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a G/G/S/∞/H model

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H_Y, G_G_S_K, OpenNetwork

G_G_S_INF_H_Y *Obtains the main characteristics of a G/G/S/∞/H with Y replacements model by simulation*

Description

Obtains the main characteristics of a G/G/S/∞/H with Y replacements model by simulation

Usage

```
G_G_S_INF_H_Y(arr.distr = Exp(1), serv.distr = Exp(1),
  s = 2, H = 2, Y = 3, staClients = 100, nClients = 1000,
  historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
s	Number of servers
H	Population size
Y	Number of replacements
staClients	Number of customers used in the stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a G/G/1/S/∞/H/Y model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_K, OpenNetwork

G_G_S_K *Obtains the main characteristics of a G/G/s/K model by simulation*

Description

Obtains the main characteristics of a G/G/s/K model by simulation

Usage

```
G_G_S_K(arr.distr = Exp(1), serv.distr = Exp(1), s = 2,
  K = 3, staClients = 100, nClients = 1000,
  historic = FALSE)
```

Arguments

arr.distr	Arrival distribution
serv.distr	Service distribution
s	Number of servers
K	Maximun size of the queue
staClients	Number of customers used in the stabilization stage
nClients	Number of customers used in the simulation stage
historic	Parameter to activate/deactivate the historic information

Value

Returns the next information of a G/G/S/K model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, $W$and Wq during the simulation

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, OpenNetwork

MarkovianModel *Define a queueing model*

Description

Constructor for `MarkovianModel` class.

Usage

```
MarkovianModel(arr.distr = Exp(1), serv.distr = Exp(1))
```

Arguments

`arr.distr`	Arrival distribution (object of S4-class `distr` defined in **distr** package)
`serv.distr`	Service distribution (object of S4-class `distr` defined in **distr** package)

Value

An object of class `MarkovianModel`, a list with the following components:

`arr.distr`	Arrival distribution
`serv.distr`	Service distribution

maxCustomers *Returns the maximun value for n that satisfies P(n) > 0*

Description

Returns the maximun value for n that satisfies P(n) > 0

Usage

```
maxCustomers(qm)

## S3 method for class 'MarkovianModel'
maxCustomers(qm)

## S3 method for class 'M_M_1_K'
maxCustomers(qm)

## S3 method for class 'M_M_S_K'
maxCustomers(qm)

## S3 method for class 'M_M_1_INF_H'
maxCustomers(qm)

## S3 method for class 'M_M_S_INF_H'
maxCustomers(qm)

## S3 method for class 'M_M_S_INF_H_Y'
maxCustomers(qm)
```

Arguments

qm	object MarkovianModel

Details

maxCustomers.MarkovianModel implements the default method. Returns infinite.

maxCustomers.M_M_1_K implements the method for a M/M/1/K queueing model

maxCustomers.M_M_S_K implements the method for a M/M/S/K queueing model

maxCustomers.M_M_1_INF_H implements the method for a M/M/1/∞/H queueing model

maxCustomers.M_M_S_INF_H implements the method for a M/M/s/∞/H queueing model

maxCustomers.M_M_S_INF_H_Y implements the method for a M/M/s/∞/H/Y queueing model

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M_M_1 *Obtains the main characteristics of a M/M/1 queueing model*

Description

Obtains the main characteristics of a M/M/1 queueing model

Usage

```
M_M_1(lambda = 3, mu = 6)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate

Value

Returns the next information of a M/M/1 model:

rho	Traffic intensity ρ
cn	Constant coefficients used in the computation of $P(n)$
p0	Probability of empty system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1_INF_H, M_M_1_K, M_M_INF, M_M_S, M_M_S_INF_H, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

M_M_1_INF_H *Obtains the main characteristics of a M/M/1/∞/H queueing model*

Description

Obtains the main characteristics of a M/M/1/∞/H queueing model

Usage

```
M_M_1_INF_H(lambda = 3, mu = 6, h = 5)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate
h	Population size

Value

Returns the next information of a M/M/1/∞/H model:

rho	Constant λ/ρ
barrho	Traffic intensity $\bar{\rho}$
barlambda	Mean service rate $\bar{\lambda}$
cn	Constant coefficients used in the computation of $P(n)$
p0	Probability of empty system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_K, M_M_INF, M_M_S, M_M_S_INF_H, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

M_M_1_K *Obtains the main characteristics of a M/M/1/K queueing model*

Description

Obtains the main characteristics of a M/M/1/K queueing model

Usage

```
M_M_1_K(lambda = 3, mu = 6, k = 2)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate
k	Maximun size of the queue

Value

Returns the next information of a M/M/1/K model:

rho	Constant coefficient λ/ρ
barrho	Traffic intensity $\bar{\rho}$
barlambda	Effective arrival rate $\bar{\lambda}$
l	Expected mean number of customers in the system L
lq	Expected mean number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_INF_H, M_M_INF, M_M_S, M_M_S_INF_H, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

M_M_INF *Obtains the main characteristics of a M/M/∞ queueing model*

Description

Obtains the main characteristics of a M/M/∞ queueing model

Usage

```
M_M_INF(lambda = 3, mu = 6)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate

Value

Returns the next information of a M/M/∞ model:

rho	Constant coefficient λ/ρ
barrho	Traffic intensity $\bar{\rho}$
p0	Probability of empty system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q ($L_q = 0$ in this model)
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q ($W_q = 0$ in this model)
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_INF_H, M_M_1_K, M_M_S, M_M_S_INF_H, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

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M_M_S *Obtains the main characteristics of a M/M/s queueing model*

Description

Obtains the main characteristics of a M/M/s queueing model

Usage

```
M_M_S(lambda = 3, mu = 6, s = 2)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate
s	Number of servers

Value

Returns the next information of a M/M/s model:

rho	Traffic intensity ρ
cn	Constant coefficients used in the computation of $P(n)$ C_n
p0	Probability of empty system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_INF_H, M_M_1_K, M_M_INF, M_M_S_INF_H, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

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M_M_S_INF_H *Obtains the main characteristics of a M/M/s/∞/H queueing model*

Description

Obtains the main characteristics of a M/M/s/∞/H queueing model

Usage

```
M_M_S_INF_H(lambda = 3, mu = 6, s = 3, h = 5)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate
s	Number of servers
h	Population size

Value

Returns the next information of a M/M/s/∞/H model:

rho	Constant coefficient λ/ρ
barrho	Traffic intensity $\bar{\rho}$
barlambda	Mean effective arrival rate $\bar{\lambda}$
cn	Constant coefficients used in the computation of $P(n)$
p0	Probability of empty system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_INF_H, M_M_1_K, M_M_INF, M_M_S, M_M_S_INF_H_Y, M_M_S_K, OpenJacksonNetwork

M_M_S_INF_H_Y *Obtains the main characteristics of a M/M/s/∞/H with Y replacements queueing model*

Description

Obtains the main characteristics of a M/M/s/∞/H with Y replacements queueing model

Usage

```
M_M_S_INF_H_Y(lambda = 3, mu = 6, s = 3, h = 5, y = 3)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate
s	Number of servers
h	Population size
y	Number of replacements

Value

Returns the next information of a M/M/s/∞/H/Y model:

rho	Constant coefficient λ/ρ
barrho	Traffic intensity $\bar{\rho}$
barlambda	Effective arrival rate $\bar{\lambda}$
cn	Constant coefficients used in the computation of $P(n)$ C_n
p0	Probability of 0 customers in the system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queue L_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_INF_H, M_M_1_K, M_M_INF, M_M_S, M_M_S_INF_H, M_M_S_K, OpenJacksonNetwork

M_M_S_K *Obtains the main characteristics of a M/M/S/k queueing model*

Description

Obtains the main characteristics of a M/M/S/k queueing model

Usage

```
M_M_S_K(lambda = 3, mu = 6, s = 2, k = 3)
```

Arguments

lambda	Mean arrival rate
mu	Mean service rate
s	Number of servers
k	Maximun size of the queue

Value

Returns the next information of a M/M/S/K model:

rho	Constant coefficient λ/ρ
barrho	Traffic intensity $\bar{\rho}$
barlambda	Effective arrival rate $\bar{\lambda}$
cn	Constant coefficients used in the computation of $P(n)$
pks	Probability of $K+s$ customers in the system P_{K+s}
p0	Probability of empty system P_0
l	Expected number of customers in the system L
lq	Expected number of customers in the queueL_q
w	Expected waiting time in the system W
wq	Expected waiting time in the queue W_q
eff	Efficiency of the system $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: ClosedJacksonNetwork, M_M_1, M_M_1_INF_H, M_M_1_K, M_M_INF, M_M_S, M_M_S_INF_H, M_M_S_INF_H_Y, OpenJacksonNetwork

node — *Returns the queueing model which corresponds to the node i of the network*

Description

Returns the queueing model which corresponds to the node i of the network

Usage

```
node(net, i)
```

Arguments

net	Network
i	Node

Value

MarkovianModel object

OpenJacksonNetwork — *Obtains the main characteristics of an Open Jackson network model*

Description

Obtains the main characteristics of an Open Jackson network model

Usage

```
OpenJacksonNetwork(lambda = c(20, 30), mu = c(100, 25),
  s = c(1, 2),
  p = matrix(c(0.2, 0.25, 0.1, 0), nrow = 2, ncol = 2))
```

Arguments

lambda	Vector of arrival rates at each node
mu	Vector of mean service rates
s	Vector with the number of servers at each node
p	Routing matrix, where p_{ij} is the routing probability from node i to node j

Value

Returns the next information of an Open Jackson network model:

`rho`	Traffic intensity ρ
`l`	Vector with the expected number of customers in the nodes L
`lq`	Vector of expected number of customers in the queue of each node L_q
`w`	Vector of expected waiting time in each node W
`wq`	Vector of expected waiting time in the queue of each node W_q
`lt`	Expected number of customers in the network
`lqt`	Expected number of customers in all queues
`wt`	Total expected waiting time in the network
`wqt`	Total expected waiting time in all queues
`eff`	Efficiency $Eff = W/(W - W_q)$

See Also

Other AnaliticalModels: `ClosedJacksonNetwork`, `M_M_1`, `M_M_1_INF_H`, `M_M_1_K`, `M_M_INF`, `M_M_S`, `M_M_S_INF_H`, `M_M_S_INF_H_Y`, `M_M_S_K`

`OpenNetwork` *Obtains the main characteristics of an Open Network model by simulation*

Description

Obtains the main characteristics of an Open Network model by simulation

Usage

```
OpenNetwork(arr.distr, serv.distr, s, p, staClients,
  transitions, historic = FALSE)
```

Arguments

`arr.distr`	PairList indicating the arrival distribution and the node that uses it.
`serv.distr`	Vector of service distribution in each node
`s`	Vector of servers in each node
`p`	Routing matrix, where p_{ij} is the routing probability from node i to node j
`staClients`	Number of customers used in the stabilization stage
`transitions`	Number of transitions between nodes used in the simulation stage
`historic`	Parameter to activate/deactivate the historic information

Value

Returns the next information of an Open network model:

pn	Vector of steady-state probabilities of having n customers in the system $P(n)$
l	Vector of expected number of customers in the nodes L
lq	Vector of expected number of customers in the queues of the nodes L_q
lqt	Expected number of customers in all queues
w	Vector of expected waiting times in the nodes W
wq	Vector of expected waiting time in the queues of the nodes W_q
eff	Efficiency of the system $Eff = W/(W - Wq)$
rho	Traffic intensity ρ
historic	Optional parameter that stores the evolution of L, Lq, W and Wq during the simulation.

See Also

Other SimulatedModels: ClosedNetwork, G_G_1, G_G_1_INF_H, G_G_1_K, G_G_INF, G_G_S, G_G_S_INF_H, G_G_S_INF_H_Y, G_G_S_K

P0i *Steady-state probability of 0 customers in the system on the node i of an Open Jackson Network.*

Description

Returns the value of the probability of 0 customers in node i of an Open Jackson Network.

Usage

```
P0i(net, i)

## S3 method for class 'OpenJackson'
P0i(net, i)
```

Arguments

net	Network
i	Node

Details

P0i.OpenJackson implements the method for an Open Jackson Network model

Value

$$P_{0,i}()$$

Pi *Steady-state probability of n customers in the node i of a network.*

Description

Returns the value $P_i(n)$ in the node i of a network

Usage

```
Pi(net, n, node)

## S3 method for class 'ClosedJackson'
Pi(net, n, node)
```

Arguments

net	Network
n	Customers
node	Node

Details

Pi.ClosedJackson implements the method for a Closed Jackson Network model

Value

P(n) in the selected node

Pn *Steady-state probability of having n customers in the system*

Description

Returns the probability of having n customers in the given queueing model

Usage

```
Pn(qm, n)

## S3 method for class 'MarkovianModel'
Pn(qm, n)

## S3 method for class 'M_M_1'
Pn(qm, n)

## S3 method for class 'M_M_S'
Pn(qm, n)

## S3 method for class 'M_M_1_K'
```

```
Pn(qm, n)

 ## S3 method for class 'M_M_S_K'
Pn(qm, n)

 ## S3 method for class 'M_M_1_INF_H'
Pn(qm, n)

 ## S3 method for class 'M_M_S_INF_H'
Pn(qm, n)

 ## S3 method for class 'M_M_S_INF_H_Y'
Pn(qm, n)

 ## S3 method for class 'M_M_INF'
Pn(qm, n)

 ## S3 method for class 'OpenJackson'
Pn(qm, n)

 ## S3 method for class 'ClosedJackson'
Pn(qm, n)
```

Arguments

qm	Queueing model
n	Customers

Details

Pn.MarkovianModel implements the default method (generates a message)

Pn.M_M_1 implements the method for a M/M/1 queueing model

Pn.M_M_S implements the method for a M/M/S queueing model

Pn.M_M_1_K implements the method for a M/M/1/K queueing model

Pn.M_M_S_K implements the method for a M/M/S/K queueing model

Pn.M_M_1_INF_H implements the method for a M/M/1/∞/H queueing model

Pn.M_M_S_INF_H implements the method for a M/M/s/∞/H queueing model

Pn.M_M_S_INF_H_Y implements the method for a M/M/s/∞/H/Y queueing model

Pn.M_M_INF implements the method for a M_M_INF queueing model

Pn.OpenJackson implements the method for an Open Jackson Network model In this function n, should have the same length than the number of nodes in the network.

Pn.ClosedJackson implements the method for a Closed Jackson Network model In this function n, should have the same length than the number of nodes in the network.

Value

$$P(n)$$

Qn *Steady-state probability of finding n customers in the system when a new customer arrives*

Description

Returns the probability of n customers in the system in the moment of the arrival of a customer.

Usage

```
Qn(qm, n)

## S3 method for class 'MarkovianModel'
Qn(qm, n)

## S3 method for class 'M_M_1_K'
Qn(qm, n)

## S3 method for class 'M_M_S_K'
Qn(qm, n)

## S3 method for class 'M_M_1_INF_H'
Qn(qm, n)

## S3 method for class 'M_M_S_INF_H'
Qn(qm, n)

## S3 method for class 'M_M_S_INF_H_Y'
Qn(qm, n)
```

Arguments

qm	Queueing model
n	Customers

Details

Qn.MarkovianModel implements the default method (generates a message).

Qn.M_M_1_K implements the method for a M/M/1/K queueing model

Qn.M_M_S_K implements the method for a M/M/S/K queueing model

Qn.M_M_1_INF_H implements the method for a M/M/1/∞/H queueing model

Qn.M_M_S_INF_H implements the method for a M/M/s/∞/H queueing model

Qn.M_M_S_INF_H_Y implements the method for a M/M/s/∞/H with Y replacements queueing model

Value

$$Q(n)$$

summary.MarkovianModel *Shows the main graphics of the parameters of a Markovian Model*

Description

Shows the main graphics of the parameters of a Markovian Model

Usage

```
 ## S3 method for class 'MarkovianModel'
summary(object,
   t = list(range = seq(object$out$w, object$out$w * 3, length.out = 100)),
   n = c(0:5), ...)
```

Arguments

object	Markovian Model
t	Range of t
n	Range of n
...	Further arguments passed to or from other methods.

summary.SimulatedModel *Shows the main graphics of the parameters of a Simulated Model*

Description

Shows the main graphics of the parameters of a Simulated Model

Usage

```
 ## S3 method for class 'SimulatedModel'
summary(object, range = NULL,
   ...)
```

Arguments

object	Simulated Model
range	Range of the graphics
...	Further arguments passed to or from other methods.

summaryPnQn *Shows a plot of P(n) and Q(n) values of a Markovian Model*

Description

Shows a plot of P(n) and Q(n) values of a Markovian Model

Usage

```
summaryPnQn(object, n, graphics = "ggplot2")
```

Arguments

object	Markovian Model
n	Range of n
graphics	Type of graphics: "graphics" use the basic R plot and "ggplot2" the library ggplot2

summaryWtWqt *Shows a plot of W(t) and Wq(t) values of a Markovian Model*

Description

Shows a plot of W(t) and Wq(t) values of a Markovian Model

Usage

```
summaryWtWqt(object, t, graphics = "ggplot2")
```

Arguments

object	Markovian Model
t	Range of t
graphics	Type of graphics: "graphics" use the basic R plot and "ggplot2" the library ggplot2

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