

Package ‘ibmcrafr’

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Type Package

Title Toolkits to Develop Individual-Based Models in Infectious Disease

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Description It provides a generic set of tools for initializing a synthetic population with each individual in specific disease states, and making transitions between those disease states according to the rates calculated on each timestep. The new version 1.0.0 has C++ code integration to make the functions run faster. It has also a higher level function to actually run the transitions for the number of timesteps that users specify. Additional functions will follow for changing attributes on demographic, health belief and movement.

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LazyData TRUE

RoxygenNote 5.0.1

Suggests testthat

LinkingTo Rcpp

Imports Rcpp

NeedsCompilation yes

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cumprob	<i>Calculate cumulative probabilities for state transitions.</i>
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Description

This function takes in a vector of probabilities of states transitions and calculate the probability of staying in the original state and output the cumulative probabilities for all possibilities.

Usage

```
cumprob(probs, actual = FALSE)
```

Arguments

probs	A numeric vector of the probabilities of transition to states.
actual	A logical value, if TRUE, will calculate actual cumulative probabilities which may surpass 1!.

Value

A numeric vector of cumulative probabilities inclusive of the probability of having the same state in the next timestep.

Examples

```
cumprob(c(.2, .2, .9))
cumprob(c(.2, .2, .9), actual=TRUE)
cumprob(c(.2, .2, .2))
```

rate2prob	<i>Miscellaneous functions to support the ibmcrafter packare are here.</i>
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Description

Miscellaneous functions to support the ibmcrafter packare are here.

Usage

```
rate2prob(rates)
```

Arguments

rates A numeric scalar or vector to be transformed into rates.

Value

A numeric scalar or vector in terms of probabilities.

Examples

```
rate2prob(c(.1, .5))
```

run_state_trans	<i>Run state_trans function over a given number of timesteps.</i>
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Description

Organize population data and transition parameters to run state_trans function over the given number of timesteps.

Usage

```
run_state_trans(timesteps, param, pop, transient = "", useC = TRUE)
```

Arguments

timesteps A numeric scalar based on which the state_trans function will run for that specific no. of timesteps and accumulate the results.

param A list of lists. Each low-level list must contain transition parameters required by the state_trans function.

pop A state matrix created from syn_pop function. This matrix represents the states of the population.

transient A character vector. Each element must include formula(e)/expression(s) to evaluate dynamic parameters after each timestep.

useC A logical value, which is TRUE by default, will run state_transition function written in RCPP, stRCPP.

Value

A summary matrix of the states all individuals in the population are in.

Examples

```

pop <- syn_pop(c(19,1,0,0,0)) #synthesizing population
b <- 2 #effective contact rate
param <- list(
  list(1,c(2,5),c(NA,.1)), #transition from state 1 to 2 using FOI lambda
  list(2,3,100), #transition from state 2 to 3,
  list(3,4,100) #the 3rd term ensures the transition to the next stage
)

timesteps <- 10
transient <- c("param[[1]][[3]][1] <- rate2prob(b*sum(pop[,2],pop[,3])/sum(pop))")
eval(parse(text=transient))

run_state_trans(timesteps, param, pop, transient)
run_state_trans(timesteps, param, pop, transient, useC = FALSE)

```

state_trans	<i>Make state transitions.</i>
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Description

Take in the matrix of the states of synthetic population (created by `syn_pop` function) and calculate the transitions from one state to other state(s) using the transition rate(s).

Usage

```
state_trans(origin, new.states, params, s.matrix)
```

Arguments

origin	A number which represents the column index <code>s.matrix</code> you want to do the transition from
new.states	A numeric vector or a number which represents the column index <code>s.matrix</code> you want as the destination(s) for the transition
params	A numeric vector of similar length to <code>new.states</code> which serves as the transition rate(s)
s.matrix	A state matrix created from <code>syn_pop</code> function

Value

A transition matrix of the same dimension as `s.matrix`. -1 indicates that the individual has left the corresponding state. +1 indicates that the individual has become the corresponding state.

Examples

```
pop <- syn_pop(c(19,1,0,0))
state_trans(1,2,.1,pop)
state_trans(1,4,100,pop)
```

stRCPP

Make state transitions using Rcpp.

Description

Take in the matrix of the states of synthetic population (created by `syn_pop` function) and calculate the transitions from one state to other state(s) using the transition probabilities [not rate(s)]. The major difference from the R alone version was that instead of having the transition rate(s), transition probabilities are used. These probabilities will thus be calculated with another function.

Usage

```
stRCPP(origin, new.states, params, s.matrix)
```

Arguments

<code>origin</code>	A number which represents the column index <code>s.matrix</code> you want to do the transition from
<code>new.states</code>	A numeric vector or a number which represents the column index <code>s.matrix</code> you want as the destination(s) for the transition
<code>params</code>	A numeric vector of similar length to <code>new.states</code> which serves as the transition rate(s)
<code>s.matrix</code>	A state matrix created from <code>syn_pop</code> function

Value

A transition matrix of the same dimension as `s.matrix`. -1 indicates that the individual has left the corresponding state. +1 indicates that the individual has become the corresponding state.

Examples

```
pop <- syn_pop(c(19,1,0,0))
stRCPP(1,2,.1,pop)
```

`syn_pop`*Create a synthetic population having several states.*

Description

Populate a matrix in which columns represent the states of the individuals and rows represent the individuals.

Usage

```
syn_pop(states, shuffle = FALSE)
```

Arguments

<code>states</code>	A numeric vector with each element representing the number of individuals in a particular state its index corresponds to.
<code>shuffle</code>	A logical value to enable shuffling of the individuals (rows) in the resulting matrix.

Value

A matrix of 0s, and 1s. The rows representing the individuals and the columns representing the states the individuals are in

Examples

```
syn_pop(c(3,2,1))  
syn_pop(c(0,0,1,5), shuffle=TRUE)
```

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