

# Package ‘DES’

January 20, 2025

**Version** 1.0.0

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**Date** 2017-9-13

**Title** Discrete Event Simulation

**Description** Discrete event simulation (DES) involves modeling of systems having discrete, i.e. abrupt, state changes. For instance, when a job arrives to a queue, the queue length abruptly increases by 1. This package is an R implementation of the event-oriented approach to DES; see the tutorial in Matloff (2008)  
<<http://heather.cs.ucdavis.edu/~matloff/156/PLN/DESIntro.pdf>>.

**Depends** stats,utils

**LazyLoad** no

**License** MIT + file LICENSE

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2017-09-16 20:11:57 UTC

## Contents

newsim,schedevnt,getnextevnt,mainloop,newqueue,appendfcfs,delfcfs,cancelevnt,exparrivals 1

**Index** 4

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newsim,schedevnt,getnextevnt,mainloop,newqueue,appendfcfs,delfcfs,cancelevnt,exparrivals  
*Discrete-event simulation routines.*

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## Description

Main simulation routines.

**Usage**

```

newsim(timelim,maxesize,appcols=NULL,aevntset = FALSE,dbg=FALSE)
schedevnt(simlist,evnttime,evnttype,appdata=NULL)
getnextevnt(simlist)
mainloop(simlist)
newqueue(simlist)
appendfcfs(queue,jobtoqueue)
delfcfs(queue)
cancelevnt(rownum,simlist)
exparrivals(simlist,meaninterarr,batchsize = 10000)

```

**Arguments**

appcols	Names of columns in the event set for application-specific data.
aevntset	If TRUE, exparrivals will be used for arrivals and an arrivals event set will be maintained.
dbg	If TRUE, use debug mode, action pausing for each new event occurrence.
simlist	An R environment containing the simulation, produced by newsim.
evnttime	Occurrence time for an event.
evnttype	Event type.
appdata	Application-specific data.
timelim	Time limit for simulation.
maxesize	Maximum number of rows needed in the event set matrix, excluding separate arrival event rows in the case aevntset = TRUE. (The matrix can be expanded dynamically if needed.)
queue	A queue. Must be in a simlist environment.
jobtoqueue	Job to be placed in a queue.
rownum	Number of the row to be deleted from the event set.
meaninterarr	Mean time between arrivals.
batchsize	Number of arrivals to generate in one call to rexp.

**Details**

Discrete event simulation, using the event-oriented approach.

Here is an overview of the functions:

- `newsim`: Creates an R environment, containing the event list, current simulated time and so on, including any application-specific data.
- `cancelevnt`: Removes an event from the event set Useful for instance for simulating timeout situations. Removal is done via setting the event time to double `timelim`.
- `schedevnt`: Creates a new event, and then enters it into the event set matrix.
- `getnextevnt`: Removes and returns the earliest event from the event set. Removal is done via setting the event time to double `timelim`.

- `mainloop`: Called by the application to start the simulation and run until the simulated time exceeds the user-specified time limit. At each iteration, calls `getnextevnt` and invokes the application-specific reaction function for the occurred event. If `dbg` is set, then at each iteration the function will enter R browser mode, printing out the current event and simulated time, and giving the user an opportunity to "take a look around."
- `newqueue`: Create a new work queue, an R environment. The main component, `m`, is a matrix representing the queue, with number of columns being application-dependent. The user might add other components, e.g. running totals.
- `appendfcfs`: Appends a job to a First Come, First Served queue. The job is represented by a vector to be added as a row in the queue matrix.
- `delfcfs`: Deletes and returns the head of an FCFS queue.

### Reaction Functions

These are user-defined. The DES function `mainloop` will make the call `simlist$reactevent(head, simlist)`

where the user has initially set `simlist$reactevent` to his/her application-specific code. Here `head` is the event just now removed from the head of the event set, and `simlist` is the event set. Let's call this function the "event handler," but note that within it there are if/else cases, one for each event type.

For example, consider simulation of a single-server queue. When a job arrives, the arrivals section of the event handler will run (coded by the event type, again user-defined). It will record the arrival, update any application-specific totals, and see if service can be started for this job. If so, the code will schedule an event for completion of the service; if not, the code will add the job to the queue.

### Outline of Typical Application Code

```
mysim <- newsim()    # create the simlist
set reactevent in mysim
set application-specific variables in mysim, if any
set the first event(s) in mysim$evnts
mainloop(mysim,mysimtimelim)
print results
```

### Author(s)

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### Examples

```
# from MachRep.R in examples/

# create a sim list that will run for 100000 simulated time, with 3
# rows allocated for the event set, and application-specific columns
# named 'startqtime' and 'startuptime'
simlist <- newsim(100000,3,appcols=c('startqtime','startuptime'))
# create a queue
simlist$queue <- newqueue(simlist)
```

# Index

appendfcfs  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

cancelvnt  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

delfcfs  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

exparrivals  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

getnextevnt  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

mainloop  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

newqueue  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

newsim  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1

newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals,  
1

schedevnt  
(newsim, schedevnt, getnextevnt, mainloop, newqueue, appendfcfs, delfcfs, cancelvnt, exparrivals),  
1