Package 'plyr'

June 12, 2015

Version 1.8.3

Title Tools for Splitting, Applying and Combining Data

Description A set of tools that solves a common set of problems: you need to break a big problem down into manageable pieces, operate on each piece and then put all the pieces back together. For example, you might want to fit a model to each spatial location or time point in your study, summarise data by panels or collapse high-dimensional arrays to simpler summary statistics. The development of 'plyr' has been generously supported by 'Becton Dickinson'.
<pre>URL http://had.co.nz/plyr, https://github.com/hadley/plyr</pre>
<pre>BugReports https://github.com/hadley/plyr/issues</pre>
Depends R (>= $3.1.0$)
Imports Rcpp (>= 0.11.0)
LinkingTo Rcpp
Suggests abind, testthat, tcltk, foreach, doParallel, itertools, iterators
License MIT + file LICENSE
LazyData true
NeedsCompilation yes
Author Hadley Wickham [aut, cre]
Maintainer Hadley Wickham <hadley@rstudio.com></hadley@rstudio.com>
Repository CRAN
Date/Publication 2015-06-12 11:05:51
R topics documented:
aaply

3

arrange	9
as.data.frame.function	9
as.quoted	10
a_ply	11
baseball	12
colwise	13
count	15
create_progress_bar	16
daply	17
ddply	
defaults	20
desc	21
	21
	21
	24
failwith	25
here	26
idata.frame	26
join	
join_all	
laply	
ldply	30
liply	
llply	32
l_ply	33
maply	34
mapvalues	36
match_df	
mdply	38
mlply	39
mutate	41
m_ply	42
name rows	43
ozone	44
plyr	45
plyr-deprecated	46
progress_text	46
progress_time	
progress_tk	
progress_win	
raply	
rbind.fill	
rbind.fill.matrix	
rdply	
rename	
revalue	
rlply	
round_any	55

.

splat	 															
strip_splits																
summarise																
take	 															
vaggregate	 															

Index 61

Quote variables to create a list of unevaluated expressions for later evaluation.

Description

This function is similar to \textasciitilde in that it is used to capture the name of variables, not their current value. This is used throughout plyr to specify the names of variables (or more complicated expressions).

Usage

```
.(..., .env = parent.frame())
```

Arguments

unevaluated expressions to be recorded. Specify names if you want the set the names of the resultant variables
 env
 environment in which unbound symbols in . . . should be evaluated. Defaults to

the environment in which . was executed.

Details

Similar tricks can be performed with substitute, but when functions can be called in multiple ways it becomes increasingly tricky to ensure that the values are extracted from the correct frame. Substitute tricks also make it difficult to program against the functions that use them, while the quoted class provides as quoted character to convert strings to the appropriate data structure.

Value

list of symbol and language primitives

```
.(a, b, c)
.(first = a, second = b, third = c)
.(a ^ 2, b - d, log(c))
as.quoted(~ a + b + c)
as.quoted(a ~ b + c)
as.quoted(c("a", "b", "c"))
```

4 aaply

```
# Some examples using ddply - look at the column names
ddply(mtcars, "cyl", each(nrow, ncol))
ddply(mtcars, ~ cyl, each(nrow, ncol))
ddply(mtcars, .(cyl), each(nrow, ncol))
ddply(mtcars, .(log(cyl)), each(nrow, ncol))
ddply(mtcars, .(logcyl = log(cyl)), each(nrow, ncol))
ddply(mtcars, .(vs + am), each(nrow, ncol))
ddply(mtcars, .(vsam = vs + am), each(nrow, ncol))
```

aaply

Split array, apply function, and return results in an array.

Description

For each slice of an array, apply function, keeping results as an array.

Usage

```
aaply(.data, .margins, .fun = NULL, ..., .expand = TRUE,
   .progress = "none", .inform = FALSE, .drop = TRUE, .parallel = FALSE,
   .paropts = NULL)
```

Arguments

.data	matrix, array or data frame to be processed
.margins	a vector giving the subscripts to split up data by. 1 splits up by rows, 2 by columns and $c(1,2)$ by rows and columns, and so on for higher dimensions
.fun	function to apply to each piece
	other arguments passed on to . fun
. expand	if .data is a data frame, should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop	should extra dimensions of length 1 in the output be dropped, simplifying the output. Defaults to TRUE $$
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

aaply 5

Details

This function is very similar to apply, except that it will always return an array, and when the function returns >1 d data structures, those dimensions are added on to the highest dimensions, rather than the lowest dimensions. This makes aaply idempotent, so that aaply(input, X, identity) is equivalent to aperm(input, X).

Value

if results are atomic with same type and dimensionality, a vector, matrix or array; otherwise, a list-array (a list with dimensions)

Warning

Passing a data frame as first argument may lead to unexpected results, see https://github.com/hadley/plyr/issues/212.

Input

This function splits matrices, arrays and data frames by dimensions

Output

If there are no results, then this function will return a vector of length 0 (vector()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other array input: a_ply; adply; alply
Other array output: daply; laply; maply
```

```
dim(ozone)
aaply(ozone, 1, mean)
aaply(ozone, 1, mean, .drop = FALSE)
aaply(ozone, 3, mean)
aaply(ozone, c(1,2), mean)

dim(aaply(ozone, c(1,2), mean))
dim(aaply(ozone, c(1,2), mean, .drop = FALSE))

aaply(ozone, 1, each(min, max))
aaply(ozone, 3, each(min, max))
standardise <- function(x) (x - min(x)) / (max(x) - min(x))
aaply(ozone, 3, standardise)</pre>
```

6 adply

```
aaply(ozone, 1:2, standardise)
aaply(ozone, 1:2, diff)
```

adply

Split array, apply function, and return results in a data frame.

Description

For each slice of an array, apply function then combine results into a data frame.

Usage

```
adply(.data, .margins, .fun = NULL, ..., .expand = TRUE,
   .progress = "none", .inform = FALSE, .parallel = FALSE,
   .paropts = NULL, .id = NA)
```

Arguments

.data	matrix, array or data frame to be processed
.margins	a vector giving the subscripts to split up data by. 1 splits up by rows, 2 by columns and $c(1,2)$ by rows and columns, and so on for higher dimensions
.fun	function to apply to each piece
	other arguments passed on to . fun
.expand	if . data is a data frame, should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.
.id	name(s) of the index column(s). Pass NULL to avoid creation of the index column(s). Omit or pass NA to use the default names "X1", "X2", Otherwise, this argument must have the same length as .margins.

Value

A data frame, as described in the output section.

Input

This function splits matrices, arrays and data frames by dimensions

alply 7

Output

The most unambiguous behaviour is achieved when . fun returns a data frame - in that case pieces will be combined with <code>rbind.fill</code>. If .fun returns an atomic vector of fixed length, it will be <code>rbinded</code> together and converted to a data frame. Any other values will result in an error.

If there are no results, then this function will return a data frame with zero rows and columns (data.frame()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other array input: a_ply; aaply; alply
Other data frame output: ddply; ldply; mdply
```

alply

Split array, apply function, and return results in a list.

Description

For each slice of an array, apply function then combine results into a list.

Usage

```
alply(.data, .margins, .fun = NULL, ..., .expand = TRUE,
   .progress = "none", .inform = FALSE, .parallel = FALSE,
   .paropts = NULL, .dims = FALSE)
```

Arguments

.data	matrix, array or data frame to be processed
.margins	a vector giving the subscripts to split up data by. 1 splits up by rows, 2 by columns and $c(1,2)$ by rows and columns, and so on for higher dimensions
. fun	function to apply to each piece
	other arguments passed on to . fun
. expand	if . data is a data frame, should output be $1d$ (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach

8 alply

. paropts a list of additional options passed into the foreach function when parallel com-

putation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

. dims if TRUE, copy over dimensions and names from input.

Details

The list will have "dims" and "dimnames" corresponding to the margins given. For instance alply(x, c(3,2), ...) where x has dims c(4,3,2) will give a result with dims c(2,3).

alply is somewhat similar to apply for cases where the results are not atomic.

Value

list of results

Input

This function splits matrices, arrays and data frames by dimensions

Output

If there are no results, then this function will return a list of length 0 (list()).

References

```
Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.
```

See Also

```
Other array input: a_ply; aaply; adply
Other list output: dlply; llply; mlply
```

```
alply(ozone, 3, quantile)
alply(ozone, 3, function(x) table(round(x)))
```

arrange 9

arrange

Order a data frame by its colums.

Description

This function completes the subsetting, transforming and ordering triad with a function that works in a similar way to subset and transform but for reordering a data frame by its columns. This saves a lot of typing!

Usage

```
arrange(df, ...)
```

Arguments

df data frame to reorder

... expressions evaluated in the context of df and then fed to order

See Also

order for sorting function in the base package

Examples

```
# sort mtcars data by cylinder and displacement
mtcars[with(mtcars, order(cyl, disp)), ]
# Same result using arrange: no need to use with(), as the context is implicit
# NOTE: plyr functions do NOT preserve row.names
arrange(mtcars, cyl, disp)
# Let's keep the row.names in this example
myCars = cbind(vehicle=row.names(mtcars), mtcars)
arrange(myCars, cyl, disp)
# Sort with displacement in descending order
arrange(myCars, cyl, desc(disp))
```

```
as.data.frame.function
```

Make a function return a data frame.

Description

Create a new function that returns the existing function wrapped in a data.frame with a single column, value.

10 as.quoted

Usage

```
## S3 method for class 'function'
as.data.frame(x, row.names, optional, ...)
```

Arguments

x	function to make return a data frame
row.names	necessary to match the generic, but not used
optional	necessary to match the generic, but not used
• • •	necessary to match the generic, but not used

Details

This is useful when calling *dply functions with a function that returns a vector, and you want the output in rows, rather than columns. The value column is always created, even for empty inputs.

as.quoted

Convert input to quoted variables.

Description

Convert characters, formulas and calls to quoted .variables

Usage

```
as.quoted(x, env = parent.frame())
```

Arguments

x input to quote

env environment in which unbound symbols in expression should be evaluated. De-

faults to the environment in which as . quoted was executed.

Details

This method is called by default on all plyr functions that take a .variables argument, so that equivalent forms can be used anywhere.

Currently conversions exist for character vectors, formulas and call objects.

Value

a list of quoted variables

See Also

.

a_*ply* 11

Examples

```
as.quoted(c("a", "b", "log(d)"))
as.quoted(a ~ b + log(d))
```

a_ply

Split array, apply function, and discard results.

Description

For each slice of an array, apply function and discard results

Usage

```
a_ply(.data, .margins, .fun = NULL, ..., .expand = TRUE,
   .progress = "none", .inform = FALSE, .print = FALSE,
   .parallel = FALSE, .paropts = NULL)
```

Arguments

Sumones	
.data	matrix, array or data frame to be processed
.margins	a vector giving the subscripts to split up data by. 1 splits up by rows, 2 by columns and $c(1,2)$ by rows and columns, and so on for higher dimensions
. fun	function to apply to each piece
	other arguments passed on to . fun
.expand	if . data is a data frame, should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.print	automatically print each result? (default: FALSE)
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Value

Nothing

Input

This function splits matrices, arrays and data frames by dimensions

12 baseball

Output

All output is discarded. This is useful for functions that you are calling purely for their side effects like displaying plots or saving output.

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other array input: aaply; adply; alply
Other no output: d_ply; l_ply; m_ply
```

basebal1

Yearly batting records for all major league baseball players

Description

This data frame contains batting statistics for a subset of players collected from http://www.baseball-databank.org/. There are a total of 21,699 records, covering 1,228 players from 1871 to 2007. Only players with more 15 seasons of play are included.

Usage

basebal1

Format

A 21699 x 22 data frame

Variables

Variables:

- id, unique player id
- · year, year of data
- stint
- team, team played for
- lg, league
- g, number of games
- ab, number of times at bat
- r, number of runs
- h, hits, times reached base because of a batted, fair ball without error by the defense
- X2b, hits on which the batter reached second base safely

colwise 13

- X3b, hits on which the batter reached third base safely
- hr, number of home runs
- rbi, runs batted in
- sb, stolen bases
- cs, caught stealing
- bb, base on balls (walk)
- so, strike outs
- ibb, intentional base on balls
- hbp, hits by pitch
- · sh, sacrifice hits
- · sf, sacrifice flies
- gidp, ground into double play

References

```
http://www.baseball-databank.org/
```

Examples

```
baberuth <- subset(baseball, id == "ruthba01")
baberuth$cyear <- baberuth$year - min(baberuth$year) + 1

calculate_cyear <- function(df) {
    mutate(df,
        cyear = year - min(year),
        cpercent = cyear / (max(year) - min(year))
    )
}

baseball <- ddply(baseball, .(id), calculate_cyear)
baseball <- subset(baseball, ab >= 25)

model <- function(df) {
    lm(rbi / ab ~ cyear, data=df)
}
model(baberuth)
models <- dlply(baseball, .(id), model)</pre>
```

colwise

Column-wise function.

Description

Turn a function that operates on a vector into a function that operates column-wise on a data.frame.

14 colwise

Usage

```
colwise(.fun, .cols = true, ...)
catcolwise(.fun, ...)
numcolwise(.fun, ...)
```

Arguments

. fun	function
.cols	either a function that tests columns for inclusion, or a quoted object giving which columns to process
	other arguments passed on to . fun

Details

catcolwise and numcolwise provide version that only operate on discrete and numeric variables respectively.

```
# Count number of missing values
nmissing <- function(x) sum(is.na(x))</pre>
# Apply to every column in a data frame
colwise(nmissing)(baseball)
# This syntax looks a little different. It is shorthand for the
# the following:
f <- colwise(nmissing)</pre>
f(baseball)
# This is particularly useful in conjunction with d*ply
ddply(baseball, .(year), colwise(nmissing))
# To operate only on specified columns, supply them as the second
# argument. Many different forms are accepted.
ddply(baseball, .(year), colwise(nmissing, .(sb, cs, so)))
ddply(baseball, .(year), colwise(nmissing, c("sb", "cs", "so")))
ddply(baseball, .(year), colwise(nmissing, ~ sb + cs + so))
# Alternatively, you can specify a boolean function that determines
# whether or not a column should be included
ddply(baseball, .(year), colwise(nmissing, is.character))
ddply(baseball, .(year), colwise(nmissing, is.numeric))
ddply(baseball, .(year), colwise(nmissing, is.discrete))
# These last two cases are particularly common, so some shortcuts are
# provided:
ddply(baseball, .(year), numcolwise(nmissing))
ddply(baseball, .(year), catcolwise(nmissing))
```

count 15

```
# You can supply additional arguments to either colwise, or the function
# it generates:
numcolwise(mean)(baseball, na.rm = TRUE)
numcolwise(mean, na.rm = TRUE)(baseball)
```

count

Count the number of occurences.

Description

Equivalent to as.data.frame(table(x)), but does not include combinations with zero counts.

Usage

```
count(df, vars = NULL, wt_var = NULL)
```

Arguments

df data frame to be processed

variables to count unique values of

wt_var optional variable to weight by - if this is non-NULL, count will sum up the value

of this variable for each combination of id variables.

Details

Speed-wise count is competitive with table for single variables, but it really comes into its own when summarising multiple dimensions because it only counts combinations that actually occur in the data.

Compared to table + as.data.frame, count also preserves the type of the identifier variables, instead of converting them to characters/factors.

Value

a data frame with label and freq columns

See Also

table for related functionality in the base package

16 create_progress_bar

Examples

```
# Count of each value of "id" in the first 100 cases
count(baseball[1:100,], vars = "id")
# Count of ids, weighted by their "g" loading
count(baseball[1:100,], vars = "id", wt_var = "g")
count(baseball, "id", "ab")
count(baseball, "lg")
# How many stints do players do?
count(baseball, "stint")
# Count of times each player appeared in each of the years they played
count(baseball[1:100,], c("id", "year"))
# Count of counts
count(count(baseball[1:100,], c("id", "year")), "id", "freq")
count(count(baseball, c("id", "year")), "freq")
```

create_progress_bar

Create progress bar.

Description

Create progress bar object from text string.

Usage

```
create_progress_bar(name = "none", ...)
```

Arguments

name type of progress bar to create
... other arguments passed onto progress bar function

Details

Progress bars give feedback on how apply step is proceeding. This is mainly useful for long running functions, as for short functions, the time taken up by splitting and combining may be on the same order (or longer) as the apply step. Additionally, for short functions, the time needed to update the progress bar can significantly slow down the process. For the trivial examples below, using the tk progress bar slows things down by a factor of a thousand.

Note the that progress bar is approximate, and if the time taken by individual function applications is highly non-uniform it may not be very informative of the time left.

There are currently four types of progress bar: "none", "text", "tk", and "win". See the individual documentation for more details. In plyr functions, these can either be specified by name, or you can create the progress bar object yourself if you want more control over its apperance. See the examples.

See Also

```
progress_none, progress_text, progress_tk, progress_win
```

daply 17

Examples

```
# No progress bar
l_ply(1:100, identity, .progress = "none")
## Not run:
# Use the Tcl/Tk interface
l_ply(1:100, identity, .progress = "tk")

## End(Not run)
# Text-based progress (|======|)
l_ply(1:100, identity, .progress = "text")
# Choose a progress character, run a length of time you can see
l_ply(1:10000, identity, .progress = progress_text(char = "."))
```

daply

Split data frame, apply function, and return results in an array.

Description

For each subset of data frame, apply function then combine results into an array. daply with a function that operates column-wise is similar to aggregate. To apply a function for each row, use aaply with .margins set to 1.

Usage

```
daply(.data, .variables, .fun = NULL, ..., .progress = "none",
    .inform = FALSE, .drop_i = TRUE, .drop_o = TRUE, .parallel = FALSE,
    .paropts = NULL)
```

Arguments

.data	data frame to be processed
.variables	variables to split data frame by, as quoted variables, a formula or character vector
.fun	function to apply to each piece
	other arguments passed on to . fun
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop_i	should combinations of variables that do not appear in the input data be preserved (FALSE) or dropped (TRUE, default)
.drop_o	should extra dimensions of length 1 in the output be dropped, simplifying the output. Defaults to $TRUE$
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

18 ddply

Value

if results are atomic with same type and dimensionality, a vector, matrix or array; otherwise, a list-array (a list with dimensions)

Input

This function splits data frames by variables.

Output

If there are no results, then this function will return a vector of length 0 (vector()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other array output: aaply; laply; maply
Other data frame input: d_ply; ddply; dlply
```

Examples

```
daply(baseball, .(year), nrow)

# Several different ways of summarising by variables that should not be
# included in the summary

daply(baseball[, c(2, 6:9)], .(year), colwise(mean))
daply(baseball[, 6:9], .(baseball$year), colwise(mean))
daply(baseball, .(year), function(df) colwise(mean)(df[, 6:9]))
```

ddply

Split data frame, apply function, and return results in a data frame.

Description

For each subset of a data frame, apply function then combine results into a data frame. To apply a function for each row, use adply with .margins set to 1.

Usage

```
ddply(.data, .variables, .fun = NULL, ..., .progress = "none",
    .inform = FALSE, .drop = TRUE, .parallel = FALSE, .paropts = NULL)
```

ddply 19

Arguments

.data	data frame to be processed
.variables	variables to split data frame by, as as.quoted variables, a formula or character vector
.fun	function to apply to each piece
	other arguments passed on to . fun
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop	should combinations of variables that do not appear in the input data be preserved (FALSE) or dropped (TRUE, default)
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Value

A data frame, as described in the output section.

Input

This function splits data frames by variables.

Output

The most unambiguous behaviour is achieved when .fun returns a data frame - in that case pieces will be combined with <code>rbind.fill</code>. If .fun returns an atomic vector of fixed length, it will be <code>rbinded</code> together and converted to a data frame. Any other values will result in an error.

If there are no results, then this function will return a data frame with zero rows and columns (data.frame()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

tapply for similar functionality in the base package

Other data frame input: d_ply; daply; dlply
Other data frame output: adply; ldply; mdply

20 defaults

Examples

```
# Summarize a dataset by two variables
dfx <- data.frame(</pre>
  group = c(rep('A', 8), rep('B', 15), rep('C', 6)),
  sex = sample(c("M", "F"), size = 29, replace = TRUE),
  age = runif(n = 29, min = 18, max = 54)
)
# Note the use of the '.' function to allow
# group and sex to be used without quoting
ddply(dfx, .(group, sex), summarize,
mean = round(mean(age), 2),
 sd = round(sd(age), 2))
# An example using a formula for .variables
ddply(baseball[1:100,], ~ year, nrow)
# Applying two functions; nrow and ncol
ddply(baseball, .(lg), c("nrow", "ncol"))
# Calculate mean runs batted in for each year
rbi <- ddply(baseball, .(year), summarise,</pre>
  mean_rbi = mean(rbi, na.rm = TRUE))
# Plot a line chart of the result
plot(mean_rbi ~ year, type = "l", data = rbi)
# make new variable career_year based on the
# start year for each player (id)
base2 <- ddply(baseball, .(id), mutate,</pre>
career_year = year - min(year) + 1
```

defaults

Set defaults.

Description

Convient method for combining a list of values with their defaults.

Usage

```
defaults(x, y)
```

Arguments

У

```
x list of values
```

defaults

desc 21

desc

Descending order.

Description

Transform a vector into a format that will be sorted in descending order.

Usage

```
desc(x)
```

Arguments

Х

vector to transform

Examples

```
desc(1:10)
desc(factor(letters))
first_day <- seq(as.Date("1910/1/1"), as.Date("1920/1/1"), "years")
desc(first_day)</pre>
```

dlply

Split data frame, apply function, and return results in a list.

Description

For each subset of a data frame, apply function then combine results into a list. dlply is similar to by except that the results are returned in a different format. To apply a function for each row, use alply with .margins set to 1.

Usage

```
dlply(.data, .variables, .fun = NULL, ..., .progress = "none",
    .inform = FALSE, .drop = TRUE, .parallel = FALSE, .paropts = NULL)
```

Arguments

•	data	data frame to be processed
	variables	variables to split data frame by, as ${\tt as.quoted}$ variables, a formula or character vector
	fun	function to apply to each piece
		other arguments passed on to . fun
	progress	name of the progress bar to use, see create_progress_bar

22 dlply

.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop	should combinations of variables that do not appear in the input data be preserved (FALSE) or dropped (TRUE, default)
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Value

list of results

Input

This function splits data frames by variables.

Output

If there are no results, then this function will return a list of length 0 (list()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other data frame input: d_ply; daply; ddply
Other list output: alply; llply; mlply
```

```
linmod <- function(df) {
   lm(rbi ~ year, data = mutate(df, year = year - min(year)))
}
models <- dlply(baseball, .(id), linmod)
models[[1]]

coef <- ldply(models, coef)
with(coef, plot(`(Intercept)`, year))
qual <- laply(models, function(mod) summary(mod)$r.squared)
hist(qual)</pre>
```

d_ply 23

d_ply

Split data frame, apply function, and discard results.

Description

For each subset of a data frame, apply function and discard results. To apply a function for each row, use a_ply with .margins set to 1.

Usage

```
d_ply(.data, .variables, .fun = NULL, ..., .progress = "none",
    .inform = FALSE, .drop = TRUE, .print = FALSE, .parallel = FALSE,
    .paropts = NULL)
```

Arguments

.data	data frame to be processed
.variables	variables to split data frame by, as ${\tt as.quoted}$ variables, a formula or character vector
. fun	function to apply to each piece
	other arguments passed on to . fun
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop	should combinations of variables that do not appear in the input data be preserved (FALSE) or dropped (TRUE, default)
.print	automatically print each result? (default: FALSE)
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the <code>foreach</code> function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Value

Nothing

Input

This function splits data frames by variables.

Output

All output is discarded. This is useful for functions that you are calling purely for their side effects like displaying plots or saving output.

24 each

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other data frame input: daply; ddply; dlply
Other no output: a_ply; l_ply; m_ply
```

each

Aggregate multiple functions into a single function.

Description

Combine multiple functions into a single function returning a named vector of outputs. Note: you cannot supply additional parameters for the summary functions

Usage

```
each(...)
```

Arguments

... functions to combine, each function should produce a single number as output

See Also

summarise for applying summary functions to data

```
# Call min() and max() on the vector 1:10
each(min, max)(1:10)
# This syntax looks a little different. It is shorthand for the
# the following:
f<- each(min, max)
f(1:10)
# Three equivalent ways to call min() and max() on the vector 1:10
each("min", "max")(1:10)
each(c("min", "max"))(1:10)
each(c(min, max))(1:10)
# Call length(), min() and max() on a random normal vector
each(length, mean, var)(rnorm(100))</pre>
```

failwith 25

failwith

Fail with specified value.

Description

Modify a function so that it returns a default value when there is an error.

Usage

```
failwith(default = NULL, f, quiet = FALSE)
```

Arguments

default default value

f function
quiet all error messages be suppressed?

Value

a function

See Also

```
try_default
```

```
f <- function(x) if (x == 1) stop("Error!") else 1
## Not run:
f(1)
f(2)
## End(Not run)
safef <- failwith(NULL, f)
safef(1)
safef(2)</pre>
```

26 idata.frame

here

Capture current evaluation context.

Description

This function captures the current context, making it easier to use **ply with functions that do special evaluation and need access to the environment where ddply was called from.

Usage

here(f)

Arguments

f

a function that does non-standard evaluation

Author(s)

Peter Meilstrup, https://github.com/crowding

Examples

```
df <- data.frame(a = rep(c("a","b"), each = 10), b = 1:20)
f1 <- function(label) {
    ddply(df, "a", mutate, label = paste(label, b))
}
## Not run: f1("name:")
# Doesn't work because mutate can't find label in the current scope
f2 <- function(label) {
    ddply(df, "a", here(mutate), label = paste(label, b))
}
f2("name:")
# Works :)</pre>
```

idata.frame

Construct an immutable data frame.

Description

An immutable data frame works like an ordinary data frame, except that when you subset it, it returns a reference to the original data frame, not a copy. This makes subsetting substantially faster and has a big impact when you are working with large datasets with many groups.

Usage

```
idata.frame(df)
```

join 27

Arguments

df a data frame

Details

This method is still a little experimental, so please let me know if you run into any problems.

Value

an immutable data frame

Examples

```
system.time(dlply(baseball, "id", nrow))
system.time(dlply(idata.frame(baseball), "id", nrow))
```

join

Join two data frames together.

Description

Join, like merge, is designed for the types of problems where you would use a sql join.

Usage

```
join(x, y, by = NULL, type = "left", match = "all")
```

Arguments

X	data frame
у	data frame

by character vector of variable names to join by. If omitted, will match on all

common variables.

type of join: left (default), right, inner or full. See details for more information.

how should duplicate ids be matched? Either match just the "first" matching row, or match "all" matching rows. Defaults to "all" for compatibility with

merge, but "first" is significantly faster.

Details

match

The four join types return:

- inner: only rows with matching keys in both x and y
- left: all rows in x, adding matching columns from y
- right: all rows in y, adding matching columns from x
- full: all rows in x with matching columns in y, then the rows of y that don't match x.

28 join_all

Note that from plyr 1.5, join will (by default) return all matches, not just the first match, as it did previously.

Unlike merge, preserves the order of x no matter what join type is used. If needed, rows from y will be added to the bottom. Join is often faster than merge, although it is somewhat less featureful - it currently offers no way to rename output or merge on different variables in the x and y data frames.

Examples

```
first <- ddply(baseball, "id", summarise, first = min(year))
system.time(b2 <- merge(baseball, first, by = "id", all.x = TRUE))
system.time(b3 <- join(baseball, first, by = "id"))

b2 <- arrange(b2, id, year, stint)
b3 <- arrange(b3, id, year, stint)
stopifnot(all.equal(b2, b3))</pre>
```

join_all

Recursively join a list of data frames.

Description

Recursively join a list of data frames.

Usage

```
join_all(dfs, by = NULL, type = "left", match = "all")
```

Arguments

dfs A list of data frames.

by character vector of variable names to join by. If omitted, will match on all common variables.

type type of join: left (default), right, inner or full. See details for more information.

match how should duplicate ids be matched? Either match just the "first" matching row, or match "all" matching rows. Defaults to "all" for compatibility with merge, but "first" is significantly faster.

```
dfs <- list(
    a = data.frame(x = 1:10, a = runif(10)),
    b = data.frame(x = 1:10, b = runif(10)),
    c = data.frame(x = 1:10, c = runif(10))
)
join_all(dfs)
join_all(dfs, "x")</pre>
```

laply 29

laply	Split list, apply function, and return results in an array.	

Description

For each element of a list, apply function then combine results into an array.

Usage

```
laply(.data, .fun = NULL, ..., .progress = "none", .inform = FALSE,
   .drop = TRUE, .parallel = FALSE, .paropts = NULL)
```

Arguments

.data	list to be processed
.fun	function to apply to each piece
	other arguments passed on to . fun
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop	should extra dimensions of length 1 in the output be dropped, simplifying the output. Defaults to TRUE
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Details

laply is similar in spirit to sapply except that it will always return an array, and the output is transposed with respect sapply - each element of the list corresponds to a row, not a column.

Value

if results are atomic with same type and dimensionality, a vector, matrix or array; otherwise, a list-array (a list with dimensions)

Input

This function splits lists by elements.

Output

If there are no results, then this function will return a vector of length 0 (vector()).

30 ldply

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other array output: aaply; daply; maply
Other list input: 1_ply; ldply; llply
```

Examples

```
laply(baseball, is.factor)
# cf
ldply(baseball, is.factor)
colwise(is.factor)(baseball)

laply(seq_len(10), identity)
laply(seq_len(10), rep, times = 4)
laply(seq_len(10), matrix, nrow = 2, ncol = 2)
```

ldply

Split list, apply function, and return results in a data frame.

Description

For each element of a list, apply function then combine results into a data frame.

Usage

```
ldply(.data, .fun = NULL, ..., .progress = "none", .inform = FALSE,
    .parallel = FALSE, .paropts = NULL, .id = NA)
```

Arguments

.data	list to be processed
. fun	function to apply to each piece
	other arguments passed on to . fun
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

liply 31

.id

name of the index column (used if .data is a named list). Pass NULL to avoid creation of the index column. For compatibility, omit this argument or pass NA to avoid converting the index column to a factor; in this case, ".id" is used as columname.

Value

A data frame, as described in the output section.

Input

This function splits lists by elements.

Output

The most unambiguous behaviour is achieved when .fun returns a data frame - in that case pieces will be combined with rbind.fill. If .fun returns an atomic vector of fixed length, it will be rbinded together and converted to a data frame. Any other values will result in an error.

If there are no results, then this function will return a data frame with zero rows and columns (data.frame()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

Other data frame output: adply; ddply; mdply

Other list input: 1_ply; laply; llply

liply

Experimental iterator based version of llply.

Description

Because iterators do not have known length, 1iply starts by allocating an output list of length 50, and then doubles that length whenever it runs out of space. This gives $O(n \ln n)$ performance rather than the $O(n \wedge 2)$ performance from the naive strategy of growing the list each time.

Usage

```
liply(.iterator, .fun = NULL, ...)
```

32

Arguments

.iterator iterator object

. fun function to apply to each piece. . . other arguments passed on to . fun

Warning

Deprecated, do not use in new code.

See Also

```
plyr-deprecated
```

llply

Split list, apply function, and return results in a list.

Description

For each element of a list, apply function, keeping results as a list.

list to be processed

Usage

```
llply(.data, .fun = NULL, ..., .progress = "none", .inform = FALSE,
    .parallel = FALSE, .paropts = NULL)
```

Arguments

.data

.paropts

.fun function to apply to each piece
... other arguments passed on to .fun
.progress name of the progress bar to use, see create_progress_bar
.inform produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.parallel if TRUE, apply function in parallel, using parallel backend provided by foreach

a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Details

11ply is equivalent to lapply except that it will preserve labels and can display a progress bar.

Value

list of results

1_ply 33

Input

This function splits lists by elements.

Output

If there are no results, then this function will return a list of length 0 (list()).

References

```
Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.
```

See Also

```
Other list input: 1_ply; laply; ldply
Other list output: alply; dlply; mlply
```

Examples

```
llply(llply(mtcars, round), table)
llply(baseball, summary)
# Examples from ?lapply
x <- list(a = 1:10, beta = exp(-3:3), logic = c(TRUE, FALSE, TRUE))
llply(x, mean)
llply(x, quantile, probs = 1:3/4)</pre>
```

1_ply

Split list, apply function, and discard results.

Description

For each element of a list, apply function and discard results

Usage

```
l_ply(.data, .fun = NULL, ..., .progress = "none", .inform = FALSE,
    .print = FALSE, .parallel = FALSE, .paropts = NULL)
```

Arguments

.data	list to be processed
.fun	function to apply to each piece
	other arguments passed on to . fun
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging

34 maply

.print	automatically print each result? (default: FALSE)
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing

Value

Nothing

Input

This function splits lists by elements.

Output

All output is discarded. This is useful for functions that you are calling purely for their side effects like displaying plots or saving output.

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other list input: laply; ldply; llply
Other no output: a_ply; d_ply; m_ply
```

Examples

```
l_ply(llply(mtcars, round), table, .print = TRUE)
l_ply(baseball, function(x) print(summary(x)))
```

maply

Call function with arguments in array or data frame, returning an array.

Description

Call a multi-argument function with values taken from columns of an data frame or array, and combine results into an array

Usage

```
maply(.data, .fun = NULL, ..., .expand = TRUE, .progress = "none",
    .inform = FALSE, .drop = TRUE, .parallel = FALSE, .paropts = NULL)
```

maply 35

Arguments

.data	matrix or data frame to use as source of arguments
.fun	function to apply to each piece
	other arguments passed on to . fun
. expand	should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.drop	should extra dimensions of length 1 in the output be dropped, simplifying the output. Defaults to \ensuremath{TRUE}
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply

Details

The m*ply functions are the plyr version of mapply, specialised according to the type of output they produce. These functions are just a convenient wrapper around a*ply with margins = 1 and . fun wrapped in splat.

them so that all cluster nodes have the correct environment set up for computing.

Value

if results are atomic with same type and dimensionality, a vector, matrix or array; otherwise, a list-array (a list with dimensions)

Input

Call a multi-argument function with values taken from columns of an data frame or array

Output

If there are no results, then this function will return a vector of length 0 (vector()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

Other array output: aaply; daply; laply

Other multiple arguments input: m_ply; mdply; mlply

36 mapvalues

Examples

```
maply(cbind(mean = 1:5, sd = 1:5), rnorm, n = 5)
maply(expand.grid(mean = 1:5, sd = 1:5), rnorm, n = 5)
maply(cbind(1:5, 1:5), rnorm, n = 5)
```

mapvalues

Replace specified values with new values, in a vector or factor.

Description

Item in x that match items from will be replaced by items in to, matched by position. For example, items in x that match the first element in from will be replaced by the first element of to.

Usage

```
mapvalues(x, from, to, warn_missing = TRUE)
```

Arguments

x the factor or vector to modify
 from a vector of the items to replace
 to a vector of replacement values
 warn_missing print a message if any of the old values are not actually present in x

Details

If x is a factor, the matching levels of the factor will be replaced with the new values.

The related revalue function works only on character vectors and factors, but this function works on vectors of any type and factors.

See Also

revalue to do the same thing but with a single named vector instead of two separate vectors.

```
x <- c("a", "b", "c")
mapvalues(x, c("a", "c"), c("A", "C"))

# Works on factors
y <- factor(c("a", "b", "c", "a"))
mapvalues(y, c("a", "c"), c("A", "C"))

# Works on numeric vectors
z <- c(1, 4, 5, 9)
mapvalues(z, from = c(1, 5, 9), to = c(10, 50, 90))</pre>
```

match_df 37

match_df

Extract matching rows of a data frame.

Description

Match works in the same way as join, but instead of return the combined dataset, it only returns the matching rows from the first dataset. This is particularly useful when you've summarised the data in some way and want to subset the original data by a characteristic of the subset.

Usage

```
match_df(x, y, on = NULL)
```

Arguments

x data frame to subset.

y data frame defining matching rows.

on variables to match on - by default will use all variables common to both data frames.

Details

match_df shares the same semantics as join, not match:

- the match criterion is ==, not identical).
- it doesn't work for columns that are not atomic vectors
- if there are no matches, the row will be omitted'

Value

a data frame

See Also

join to combine the columns from both x and y and match for the base function selecting matching items

```
# count the occurrences of each id in the baseball dataframe, then get the subset with a freq >25
longterm <- subset(count(baseball, "id"), freq > 25)
# longterm
# id freq
# 30 ansonca01 27
# 48 baineha01 27
# ...
# Select only rows from these longterm players from the baseball dataframe
```

38 mdply

```
# (match would default to match on shared column names, but here was explicitly set "id")
bb_longterm <- match_df(baseball, longterm, on="id")
bb_longterm[1:5,]</pre>
```

mdply

Call function with arguments in array or data frame, returning a data frame.

Description

Call a multi-argument function with values taken from columns of an data frame or array, and combine results into a data frame

Usage

```
mdply(.data, .fun = NULL, ..., .expand = TRUE, .progress = "none",
    .inform = FALSE, .parallel = FALSE, .paropts = NULL)
```

Arguments

.data	matrix or data frame to use as source of arguments
.fun	function to apply to each piece
	other arguments passed on to . fun
. expand	should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Details

The m*ply functions are the plyr version of mapply, specialised according to the type of output they produce. These functions are just a convenient wrapper around a*ply with margins = 1 and . fun wrapped in splat.

Value

A data frame, as described in the output section.

mlply 39

Input

Call a multi-argument function with values taken from columns of an data frame or array

Output

The most unambiguous behaviour is achieved when .fun returns a data frame - in that case pieces will be combined with rbind.fill. If .fun returns an atomic vector of fixed length, it will be rbinded together and converted to a data frame. Any other values will result in an error.

If there are no results, then this function will return a data frame with zero rows and columns (data.frame()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other data frame output: adply; ddply; ldply
Other multiple arguments input: m_ply; maply; mlply
```

Examples

mlply

Call function with arguments in array or data frame, returning a list.

Description

Call a multi-argument function with values taken from columns of an data frame or array, and combine results into a list.

Usage

```
mlply(.data, .fun = NULL, ..., .expand = TRUE, .progress = "none",
    .inform = FALSE, .parallel = FALSE, .paropts = NULL)
```

40 mlply

Arguments

.data	matrix or data frame to use as source of arguments
.fun	function to apply to each piece
	other arguments passed on to . fun
. expand	should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Details

The m*ply functions are the plyr version of mapply, specialised according to the type of output they produce. These functions are just a convenient wrapper around a*ply with margins = 1 and . fun wrapped in splat.

Value

list of results

Input

Call a multi-argument function with values taken from columns of an data frame or array

Output

If there are no results, then this function will return a list of length 0 (list()).

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

Other list output: alply; dlply; llply

Other multiple arguments input: m_ply; maply; mdply

mutate 41

Examples

```
mlply(cbind(1:4, 4:1), rep)
mlply(cbind(1:4, times = 4:1), rep)

mlply(cbind(1:4, 4:1), seq)
mlply(cbind(1:4, length = 4:1), seq)
mlply(cbind(1:4, by = 4:1), seq, to = 20)
```

mutate

Mutate a data frame by adding new or replacing existing columns.

Description

This function is very similar to transform but it executes the transformations iteratively so that later transformations can use the columns created by earlier transformations. Like transform, unnamed components are silently dropped.

Usage

```
mutate(.data, ...)
```

Arguments

.data the data frame to transform... named parameters giving definitions of new columns.

Details

Mutate seems to be considerably faster than transform for large data frames.

See Also

subset, summarise, arrange. For another somewhat different approach to solving the same problem, see within.

```
# Examples from transform
mutate(airquality, Ozone = -Ozone)
mutate(airquality, new = -Ozone, Temp = (Temp - 32) / 1.8)
# Things transform can't do
mutate(airquality, Temp = (Temp - 32) / 1.8, OzT = Ozone / Temp)
# mutate is rather faster than transform
system.time(transform(baseball, avg_ab = ab / g))
system.time(mutate(baseball, avg_ab = ab / g))
```

 m_ply

m_ply Call function with a sults.	rguments in array or data frame, discarding re-
------------------------------------	---

Description

Call a multi-argument function with values taken from columns of an data frame or array, and discard results into a list.

Usage

```
m_ply(.data, .fun = NULL, ..., .expand = TRUE, .progress = "none",
    .inform = FALSE, .print = FALSE, .parallel = FALSE, .paropts = NULL)
```

Arguments

.data	matrix or data frame to use as source of arguments
	<u> </u>
. fun	function to apply to each piece
	other arguments passed on to . fun
. expand	should output be 1d (expand = FALSE), with an element for each row; or nd (expand = TRUE), with a dimension for each variable.
.progress	name of the progress bar to use, see create_progress_bar
.inform	produce informative error messages? This is turned off by default because it substantially slows processing speed, but is very useful for debugging
.print	automatically print each result? (default: FALSE)
.parallel	if TRUE, apply function in parallel, using parallel backend provided by foreach
.paropts	a list of additional options passed into the foreach function when parallel computation is enabled. This is important if (for example) your code relies on external data or packages: use the .export and .packages arguments to supply them so that all cluster nodes have the correct environment set up for computing.

Details

The m*ply functions are the plyr version of mapply, specialised according to the type of output they produce. These functions are just a convenient wrapper around a*ply with margins = 1 and . fun wrapped in splat.

Value

Nothing

Input

Call a multi-argument function with values taken from columns of an data frame or array

name_rows 43

Output

All output is discarded. This is useful for functions that you are calling purely for their side effects like displaying plots or saving output.

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

See Also

```
Other multiple arguments input: maply; mdply; mlply
Other no output: a_ply; d_ply; l_ply
```

name_rows

Toggle row names between explicit and implicit.

Description

Plyr functions ignore row names, so this function provides a way to preserve them by converting them to an explicit column in the data frame. After the plyr operation, you can then apply name_rows again to convert back from the explicit column to the implicit rownames.

Usage

```
name_rows(df)
```

Arguments

df

a data.frame, with either rownames, or a column called .rownames.

```
name_rows(mtcars)
name_rows(name_rows(mtcars))

df <- data.frame(a = sample(10))
arrange(df, a)
arrange(name_rows(df), a)
name_rows(arrange(name_rows(df), a))</pre>
```

44 ozone

ozone

Monthly ozone measurements over Central America.

Description

This data set is a subset of the data from the 2006 ASA Data expo challenge, http://stat-computing.org/dataexpo/2006/. The data are monthly ozone averages on a very coarse 24 by 24 grid covering Central America, from Jan 1995 to Dec 2000. The data is stored in a 3d area with the first two dimensions representing latitude and longitude, and the third representing time.

Usage

ozone

Format

A 24 x 24 x 72 numeric array

References

http://stat-computing.org/dataexpo/2006/

```
value <- ozone[1, 1, ]</pre>
time <- 1:72
month.abbr <- c("Jan", "Feb", "Mar", "Apr", "May",</pre>
"Jun", "Jul", "Aug", "Sep", "Oct", "Nov", "Dec")
month <- factor(rep(month.abbr, length = 72), levels = month.abbr)</pre>
year < - rep(1:6, each = 12)
deseasf <- function(value) lm(value ~ month - 1)</pre>
models <- alply(ozone, 1:2, deseasf)</pre>
coefs <- laply(models, coef)</pre>
dimnames(coefs)[[3]] <- month.abbr</pre>
names(dimnames(coefs))[3] <- "month"</pre>
deseas <- laply(models, resid)</pre>
dimnames(deseas)[[3]] <- 1:72
names(dimnames(deseas))[3] <- "time"</pre>
dim(coefs)
dim(deseas)
```

plyr

plyr: the split-apply-combine paradigm for R.

Description

The plyr package is a set of clean and consistent tools that implement the split-apply-combine pattern in R. This is an extremely common pattern in data analysis: you solve a complex problem by breaking it down into small pieces, doing something to each piece and then combining the results back together again.

Details

The plyr functions are named according to what sort of data structure they split up and what sort of data structure they return:

- a array
- 1 list
- d data.frame
- m multiple inputs
- r repeat multiple times
- _ nothing

So ddply takes a data frame as input and returns a data frame as output, and l_ply takes a list as input and returns nothing as output.

Row names

By design, no plyr function will preserve row names - in general it is too hard to know what should be done with them for many of the operations supported by plyr. If you want to preserve row names, use name_rows to convert them into an explicit column in your data frame, perform the plyr operations, and then use name_rows again to convert the column back into row names.

Helpers

Plyr also provides a set of helper functions for common data analysis problems:

- arrange: re-order the rows of a data frame by specifying the columns to order by
- mutate: add new columns or modifying existing columns, like transform, but new columns can refer to other columns that you just created.
- summarise: like mutate but create a new data frame, not preserving any columns in the old data frame.
- join: an adapation of merge which is more similar to SQL, and has a much faster implementation if you only want to find the first match.
- match_df: a version of join that instead of returning the two tables combined together, only returns the rows in the first table that match the second.

46 progress_text

- colwise: make any function work colwise on a dataframe
- rename: easily rename columns in a data frame
- round_any: round a number to any degree of precision
- count: quickly count unique combinations and return return as a data frame.

plyr-deprecated

Deprecated Functions in Package plyr

Description

These functions are provided for compatibility with older versions of plyr only, and may be defunct as soon as the next release.

Details

- liply
- isplit2

progress_text

Text progress bar.

Description

A textual progress bar

Usage

```
progress_text(style = 3, ...)
```

Arguments

```
style style of text bar, see Details section of txtProgressBar

other arugments passed on to txtProgressBar
```

Details

This progress bar displays a textual progress bar that works on all platforms. It is a thin wrapper around the built-in setTxtProgressBar and can be customised in the same way.

See Also

Other progress bars: progress_none; progress_time; progress_tk; progress_win

```
l_ply(1:100, identity, .progress = "text")
l_ply(1:100, identity, .progress = progress_text(char = "-"))
```

progress_time 47

progress_time

Text progress bar with time.

Description

A textual progress bar that estimates time remaining. It displays the estimated time remaining and, when finished, total duration.

Usage

```
progress_time()
```

See Also

Other progress bars: progress_none; progress_text; progress_tk; progress_win

Examples

```
l_ply(1:100, function(x) Sys.sleep(.01), .progress = "time")
```

progress_tk

Graphical progress bar, powered by Tk.

Description

A graphical progress bar displayed in a Tk window

Usage

```
progress_tk(title = "plyr progress", label = "Working...", ...)
```

Arguments

title window title

label progress bar label (inside window)

... other arguments passed on to tkProgressBar

Details

This graphical progress will appear in a separate window.

See Also

```
tkProgressBar for the function that powers this progress bar
```

Other progress bars: progress_none; progress_text; progress_time; progress_win

48 progress_win

Examples

```
## Not run:
l_ply(1:100, identity, .progress = "tk")
l_ply(1:100, identity, .progress = progress_tk(width=400))
l_ply(1:100, identity, .progress = progress_tk(label=""))
## End(Not run)
```

progress_win

Graphical progress bar, powered by Windows.

Description

A graphical progress bar displayed in a separate window

Usage

```
progress_win(title = "plyr progress", ...)
```

Arguments

title window title
... other arguments passed on to winProgressBar

Details

This graphical progress only works on Windows.

See Also

```
winProgressBar for the function that powers this progress bar

Other progress bars: progress_none; progress_text; progress_time; progress_tk
```

```
if(exists("winProgressBar")) {
l_ply(1:100, identity, .progress = "win")
l_ply(1:100, identity, .progress = progress_win(title="Working..."))
}
```

raply 49

raply

Replicate expression and return results in a array.

Description

Evalulate expression n times then combine results into an array

Usage

```
raply(.n, .expr, .progress = "none", .drop = TRUE)
```

Arguments

.n number of times to evaluate the expression

. expr expression to evaluate

.progress name of the progress bar to use, see create_progress_bar

. drop should extra dimensions of length 1 be dropped, simplifying the output. Defaults

to TRUE

Details

This function runs an expression multiple times, and combines the result into a data frame. If there are no results, then this function returns a vector of length 0 (vector(0)). This function is equivalent to replicate, but will always return results as a vector, matrix or array.

Value

if results are atomic with same type and dimensionality, a vector, matrix or array; otherwise, a list-array (a list with dimensions)

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

```
raply(100, mean(runif(100)))
raply(100, each(mean, var)(runif(100)))

raply(10, runif(4))
raply(10, matrix(runif(4), nrow=2))

# See the central limit theorem in action hist(raply(1000, mean(rexp(10)))) hist(raply(1000, mean(rexp(100)))) hist(raply(1000, mean(rexp(1000))))
```

50 rbind.fill

rbind.fill

Combine data.frames by row, filling in missing columns.

Description

rbinds a list of data frames filling missing columns with NA.

Usage

```
rbind.fill(...)
```

Arguments

input data frames to row bind together. The first argument can be a list of data frames, in which case all other arguments are ignored. Any NULL inputs are silently dropped. If all inputs are NULL, the output is NULL.

Details

This is an enhancement to rbind that adds in columns that are not present in all inputs, accepts a list of data frames, and operates substantially faster.

Column names and types in the output will appear in the order in which they were encountered.

Unordered factor columns will have their levels unified and character data bound with factors will be converted to character. POSIXct data will be converted to be in the same time zone. Array and matrix columns must have identical dimensions after the row count. Aside from these there are no general checks that each column is of consistent data type.

Value

```
a single data frame
```

See Also

```
Other binding functions: rbind.fill.matrix
```

```
rbind.fill(mtcars[c("mpg", "wt")], mtcars[c("wt", "cyl")])
```

rbind.fill.matrix 51

rbind.fill.matrix

Bind matrices by row, and fill missing columns with NA.

Description

The matrices are bound together using their column names or the column indices (in that order of precedence.) Numeric columns may be converted to character beforehand, e.g. using format. If a matrix doesn't have columnes, the column number is used. Note that this means that a column with name "1" is merged with the first column of a matrix without name and so on. The returned matrix will always have column names.

Usage

```
rbind.fill.matrix(...)
```

Arguments

the matrices to rbind. The first argument can be a list of matrices, in which case all other arguments are ignored.

Details

Vectors are converted to 1-column matrices.

Matrices of factors are not supported. (They are anyways quite inconvenient.) You may convert them first to either numeric or character matrices. If a matrices of different types are merged, then normal covnersion precendence will apply.

Row names are ignored.

Value

a matrix with column names

Author(s)

C. Beleites

See Also

```
rbind, cbind, rbind, fill
```

Other binding functions: rbind.fill

52 rdply

Examples

```
A <- matrix (1:4, 2)
B <- matrix (6:11, 2)
A
B
rbind.fill.matrix (A, B)
colnames (A) <- c (3, 1)
A
rbind.fill.matrix (A, B)
rbind.fill.matrix (A, B)
```

rdply

Replicate expression and return results in a data frame.

Description

Evaluate expression n times then combine results into a data frame

Usage

```
rdply(.n, .expr, .progress = "none", .id = NA)
```

Arguments

.n number of times to evaluate the expression
 .expr expression to evaluate
 .progress name of the progress bar to use, see create_progress_bar
 .id name of the index column. Pass NULL to avoid creation of the index column. For compatibility, omit this argument or pass NA to use ".n" as column name.

Details

This function runs an expression multiple times, and combines the result into a data frame. If there are no results, then this function returns a data frame with zero rows and columns (data.frame()). This function is equivalent to replicate, but will always return results as a data frame.

Value

a data frame

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

rename 53

Examples

```
rdply(20, mean(runif(100)))
rdply(20, each(mean, var)(runif(100)))
rdply(20, data.frame(x = runif(2)))
```

rename

Modify names by name, not position.

Description

Modify names by name, not position.

Usage

```
rename(x, replace, warn_missing = TRUE, warn_duplicated = TRUE)
```

Arguments

x named object to modify

replace named character vector, with new names as values, and old names as names.

warn_missing print a message if any of the old names are not actually present in x.

warn_duplicated

print a message if any name appears more than once in x after the operation. Note: x is not altered: To save the result, you need to copy the returned data into a variable.

Examples

```
x <- c("a" = 1, "b" = 2, d = 3, 4)
# Rename column d to "c", updating the variable "x" with the result
x <- rename(x, replace = c("d" = "c"))
x
# Rename column "disp" to "displacement"
rename(mtcars, c("disp" = "displacement"))</pre>
```

revalue

Replace specified values with new values, in a factor or character vector.

Description

If x is a factor, the named levels of the factor will be replaced with the new values.

Usage

```
revalue(x, replace = NULL, warn_missing = TRUE)
```

54 rlply

Arguments

X	factor or character vector to modify	
replace	named character vector, with new values as values, and old values as names.	
warn_missing	print a message if any of the old values are not actually present in x	

Details

This function works only on character vectors and factors, but the related mapvalues function works on vectors of any type and factors, and instead of a named vector specifying the original and replacement values, it takes two separate vectors

See Also

mapvalues to replace values with vectors of any type

Examples

```
x <- c("a", "b", "c")
revalue(x, c(a = "A", c = "C"))
revalue(x, c("a" = "A", "c" = "C"))

y <- factor(c("a", "b", "c", "a"))
revalue(y, c(a = "A", c = "C"))</pre>
```

rlply

Replicate expression and return results in a list.

Description

Evalulate expression n times then combine results into a list

Usage

```
rlply(.n, .expr, .progress = "none")
```

Arguments

.n number of times to evaluate the expression

.expr expression to evaluate

.progress name of the progress bar to use, see create_progress_bar

Details

This function runs an expression multiple times, and combines the result into a list. If there are no results, then this function will return a list of length 0 (list()). This function is equivalent to replicate, but will always return results as a list.

round_any 55

Value

list of results

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

Examples

```
mods <- rlply(100, lm(y \sim x, data=data.frame(x=rnorm(100), y=rnorm(100)))) hist(laply(mods, function(x) summary(x)r.squared))
```

round_any

Round to multiple of any number.

Description

Round to multiple of any number.

Usage

```
round_any(x, accuracy, f = round)
```

Arguments

```
x numeric or date-time (POSIXct) vector to round
accuracy number to round to; for POSIXct objects, a number of seconds
f rounding function: floor, ceiling or round
```

```
round_any(135, 10)
round_any(135, 100)
round_any(135, 25)
round_any(135, 10, floor)
round_any(135, 100, floor)
round_any(135, 25, floor)
round_any(135, 10, ceiling)
round_any(135, 100, ceiling)
round_any(135, 25, ceiling)

round_any(Sys.time() + 1:10, 5)
round_any(Sys.time() + 1:10, 5, floor)
round_any(Sys.time(), 3600)
```

56 splat

r_ply

Replicate expression and discard results.

Description

Evalulate expression n times then discard results

Usage

```
r_ply(.n, .expr, .progress = "none", .print = FALSE)
```

Arguments

.n number of times to evaluate the expression

. expr expression to evaluate

.progress name of the progress bar to use, see create_progress_bar

.print automatically print each result? (default: FALSE)

Details

This function runs an expression multiple times, discarding the results. This function is equivalent to replicate, but never returns anything

References

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. http://www.jstatsoft.org/v40/i01/.

Examples

```
r_ply(10, plot(runif(50)))
r_ply(25, hist(runif(1000)))
```

splat

'Splat' arguments to a function.

Description

Wraps a function in do.call, so instead of taking multiple arguments, it takes a single named list which will be interpreted as its arguments.

Usage

```
splat(flat)
```

strip_splits 57

Arguments

flat

function to splat

Details

This is useful when you want to pass a function a row of data frame or array, and don't want to manually pull it apart in your function.

Value

a function

Examples

```
hp_per_cyl <- function(hp, cyl, ...) hp / cyl
splat(hp_per_cyl)(mtcars[1,])
splat(hp_per_cyl)(mtcars)

f <- function(mpg, wt, ...) data.frame(mw = mpg / wt)
ddply(mtcars, .(cyl), splat(f))</pre>
```

strip_splits

Remove splitting variables from a data frame.

Description

This is useful when you want to perform some operation to every column in the data frame, except the variables that you have used to split it. These variables will be automatically added back on to the result when combining all results together.

Usage

```
strip_splits(df)
```

Arguments

df

data frame produced by d*ply.

```
dlply(mtcars, c("vs", "am"))
dlply(mtcars, c("vs", "am"), strip_splits)
```

58 take

summarise

Summarise a data frame.

Description

Summarise works in an analogous way to mutate, except instead of adding columns to an existing data frame, it creates a new data frame. This is particularly useful in conjunction with ddply as it makes it easy to perform group-wise summaries.

Usage

```
summarise(.data, ...)
```

Arguments

```
.data the data frame to be summarised... further arguments of the form var = value
```

Note

Be careful when using existing variable names; the corresponding columns will be immediately updated with the new data and this can affect subsequent operations referring to those variables.

Examples

```
# Let's extract the number of teams and total period of time
# covered by the baseball dataframe
summarise(baseball,
   duration = max(year) - min(year),
   nteams = length(unique(team)))
# Combine with ddply to do that for each separate id
ddply(baseball, "id", summarise,
   duration = max(year) - min(year),
   nteams = length(unique(team)))
```

take

Take a subset along an arbitrary dimension

Description

Take a subset along an arbitrary dimension

Usage

```
take(x, along, indices, drop = FALSE)
```

vaggregate 59

Arguments

X	matrix or array to subset
along	dimension to subset along
indices	the indices to select
drop	should the dimensions of the array be simplified? Defaults to FALSE which is the opposite of the useful R default.

Examples

```
x <- array(seq_len(3 * 4 * 5), c(3, 4, 5))
take(x, 3, 1)
take(x, 2, 1)
take(x, 1, 1)
take(x, 3, 1, drop = TRUE)
take(x, 2, 1, drop = TRUE)
take(x, 1, 1, drop = TRUE)</pre>
```

vaggregate

Vector aggregate.

Description

This function is somewhat similar to tapply, but is designed for use in conjunction with id. It is simpler in that it only accepts a single grouping vector (use id if you have more) and uses vapply internally, using the .default value as the template.

Usage

```
vaggregate(.value, .group, .fun, ..., .default = NULL, .n = nlevels(.group))
```

Arguments

```
.value vector of values to aggregate
.group grouping vector
.fun aggregation function
... other arguments passed on to .fun
.default default value used for missing groups. This argument is also used as the template for function output.
.n total number of groups
```

Details

vaggregate should be faster than tapply in most situations because it avoids making a copy of the data.

60 vaggregate

```
# Some examples of use borrowed from ?tapply
n \leftarrow 17; fac \leftarrow factor(rep(1:3, length = n), levels = 1:5)
table(fac)
vaggregate(1:n, fac, sum)
vaggregate(1:n, fac, sum, .default = NA_integer_)
vaggregate(1:n, fac, range)
vaggregate(1:n, fac, range, .default = c(NA, NA) + 0)
vaggregate(1:n, fac, quantile)
# Unlike tapply, vaggregate does not support multi-d output:
tapply(warpbreaks$breaks, warpbreaks[,-1], sum)
vaggregate(warpbreaks$breaks, id(warpbreaks[,-1]), sum)
# But it is about 10x faster
x <- rnorm(1e6)</pre>
y1 <- sample.int(10, 1e6, replace = TRUE)</pre>
system.time(tapply(x, y1, mean))
system.time(vaggregate(x, y1, mean))
```

Index

*Topic datasets	cummanica 50
•	summarise, 58 take, 58
baseball, 12	*Topic utilities
ozone, 44	
*Topic debugging	create_progress_bar, 16
failwith, 25	.,3,10
*Topic manip	textasciitilde, 3
a_ply, 11	a_ply, 5, 7, 8, 11, 23, 24, 34, 43
aaply, 4	aaply, 4, 7, 8, 12, 17, 18, 30, 35
adply, 6	adply, 5, 6, 8, 12, 18, 19, 31, 39
alply, 7	aggregate, <i>17</i>
arrange, 9	alply, 5, 7, 7, 12, 21, 22, 33, 40
as.data.frame.function, 9	apply, 5, 8
count, 15	arrange, 9, 41, 45
d_ply, 23	as.data.frame, <i>15</i>
daply, 17	as.data.frame.function, 9
ddply, 18	as.quoted, 10, 19, 21, 23
defaults, 20	as. quotea, 10, 17, 21, 25
desc, 21	baseball, 12
dlply, 21	by, <i>21</i>
each, 24	
idata.frame, <mark>26</mark>	catcolwise (colwise), 13
join, 27	cbind, <i>51</i>
l_ply, 33	ceiling, 55
laply, 29	colwise, 13, 46
ldply, 30	count, 15, 46
liply, 31	create_progress_bar, 4, 6, 7, 11, 16, 17, 19,
11ply, 32	21, 23, 29, 30, 32, 33, 35, 38, 40, 42,
m_ply, 42	49, 52, 54, 56
maply, 34	d mly 12 19 10 22 22 24 42
mdply, 38	d_ply, 12, 18, 19, 22, 23, 34, 43 daply, 5, 17, 19, 22, 24, 30, 35
mlply, 39	• • •
name_rows, 43	ddply, 7, 18, 18, 22, 24, 31, 39, 45, 58 defaults, 20
r_ply, 56	desc, 21
raply,49	dlply, 8, 18, 19, 21, 24, 33, 40
rbind.fill,50	uipiy, 6, 76, 79, 21, 24, 33, 40
rbind.fill.matrix,51	each, 24
rdply,52	,
rlply,54	failwith, 25
round_any, 55	floor, <i>55</i>

INDEX

foreach, 4, 6, 8, 11, 17, 19, 22, 23, 29, 30, 32, 34, 35, 38, 40, 42	rbind, 50, 51 rbind.fill, 7, 19, 31, 39, 50, 51 rbind.fill.matrix, 50, 51
here, 26	rdply, 52
id, 59	rename, 46, 53 replicate, 49, 52, 54, 56
idata.frame, 26	revalue, 36, 53
identical, 37	rlply, 54
is.quoted(.),3	round, 55
isplit2, <i>46</i>	round_any, 46, 55
join, 27, <i>37</i> , <i>45</i>	sapply, 29
join_all,28	setTxtProgressBar,46
1 1 10 24 20 21 22 22 42 45	splat, <i>35</i> , <i>38</i> , <i>40</i> , <i>42</i> , <i>56</i>
1_ply, 12, 24, 30, 31, 33, 33, 43, 45	strip_splits,57
laply, 5, 18, 29, 31, 33–35	subset, <i>9</i> , <i>41</i>
lapply, 32	substitute, 3
ldply, 7, 19, 30, 30, 33, 34, 39	summarise, 24, 41, 45, 58
liply, 31, 46 llply, 8, 22, 30, 31, 32, 34, 40	summarize (summarise), 58
	table, <i>15</i>
m_ply, 12, 24, 34, 35, 39, 40, 42	take, 58
maply, 5, 18, 30, 34, 39, 40, 43	tapply, <i>19</i>
mapvalues, 36, 54	tkProgressBar, 47
match, 37	transform, 9, 41, 45
match_df, 37, 45	try_default, <u>25</u>
mdply, 7, 19, 31, 35, 38, 40, 43	txtProgressBar, 46
merge, 45	
mlply, 8, 22, 33, 35, 39, 39, 43	vaggregate, 59
mutate, 41, 45, 58	vapply, <i>59</i>
name_rows, 43, 45	within, <i>41</i>
numcolwise (colwise), 13	
order, 9	
ozone, 44	
plyr, 45	
plyr-deprecated, 46	
plyr-package (plyr), 45	
progress_none, <i>16</i> , <i>46</i> – <i>48</i>	
progress_text, <i>16</i> , 46, 47, 48	
progress_time, 46, 47, 47, 48	
progress_tk, <i>16</i> , <i>46</i> , <i>47</i> , 47, 48	
progress_win, <i>16</i> , <i>46</i> , <i>47</i> , 48	
quoted (.), 3	
r_ply, 56	
raply, 49	
· r-=	