

# Package ‘Bullock’

March 19, 2020

**Type** Package

**Title** Tools for table-making and miscellaneous helper utilities

**Version** 2.2.0.9000

**Date** 2020-03-18

**Imports** lmtest, magrittr, rlang, stringr

**Suggests** AER,  
crayon,  
ivpack,  
multiwayvcov,  
testthat,  
knitr,  
rmarkdown

**Description** These functions are used in John Bullock's code; they are typically needed for replication purposes. They range in complexity from a function that removes NA values from a vector prior to summing it (sumNA) to a trio of functions that produce well-formatted regression-table output (regTable, latexTable, and latexTablePDF).

**License** GPL (>= 2)

**LazyLoad** yes

**URL** <https://github.com/jbullock35/Bullock>

**BugReports** <https://github.com/jbullock35/Bullock/issues>

**RoxygenNote** 7.0.2

**Encoding** UTF-8

**Language** nob

**VignetteBuilder** knitr

## R topics documented:

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Bullock-package

*Bullock: convenience functions and tools for table generation*

---

## Description

This package provides tools that I use in my code. Most of the tools are simple convenience functions. Three of the functions—`regTable()`, `latexTable()`, and `latexTablePDF()`—are more elaborate tools for making tables, and they are designed to be used together. See the [Building better tables in less time](#) vignette for an overview.

## Details

Of the convenience functions, I most often use `qw()`, `reliability()`, `meanNA()`, and `sumNA()`.

## Author(s)

- Maintainer: John Bullock (<john@johnbullock.org>)
- Florent Delmotte [contributor]
- Dirk Edelbuettel [contributor]
- Peter Ellis [contributor]
- Simon Jackman [contributor]
- JD Long [contributor]
- Joseph Lucke [contributor]
- Matt Pettis [contributor]
- Ken Williams [contributor]

## See Also

Useful links:

- <https://github.com/jbullock35/Bullock>
- Report bugs at <https://github.com/jbullock35/Bullock/issues>

---

.ls.objects

*List objects and their characteristics*

---

## Description

lsos() and ls.objects() are like ls() in that they list the objects in a given environment. But they provide more detail: they show the class of each object, the amount of memory devoted to each objects, and the number of rows or columns of each object (if applicable).

## Usage

```
.ls.objects(
  pos = 1,
  envir = as.environment(pos),
  pattern,
  order.by,
  decreasing = FALSE,
  n = NULL
)

lsos(..., n = 8)
```

## Arguments

pos	Numeric. Specifies the position, in the search list, of the environment to search. Can be specified instead of envir.
envir	Environment to search. Can be specified instead of pos.
pattern	String. An optional regular expression; if it is specified, only objects whose names match the regular expression will be returned.
order.by	String, with value "Class", "Size", "Rows", or "Columns." The returned data frame will be sorted by the specified column.
decreasing	Logical variable. Should results be listed in decreasing order of the order.by column? In .ls.objects() the default is FALSE; in lsos(), it is TRUE.
n	Numeric. Number of objects to list. In lsos(), the default is 8.
...	Additional arguments to .ls.objects().

## Details

lsos() is a user-friendly wrapper for .ls.objects(). It is shorthand for .ls.objects(order.by="Size", decreasing=TRUE). Both functions were created by Dirk Edelbuettel and modified by JD Long and John Bullock. See <http://stackoverflow.com/questions/1358003/> for details.

**Value**

Data frame with columns "Class," "Size," "Row," and "Columns." The row names of the data frame are the names of objects in the environment.

**Author(s)**

Both functions were created by Dirk Edelbuettel and modified by JD Long. See <http://stackoverflow.com/questions/1358003/> for details.

**Examples**

```
lsos()
lsos(pattern = '\\.df$') # list only objects ending in ".df"
```

---

alpha\_cronbach

---

*Compute Cronbach's alpha for a battery of items.*


---

**Description**

This function is called by reliability. It generally should not be called by end users.

**Usage**

```
alpha_cronbach(S)
```

**Arguments**

S                      Variance-covariance matrix of responses to a battery of measurements.

**Author(s)**

Joseph F. Lucke

---

latexTable

---

*Create a LaTeX table from a matrix.*


---

**Description**

latexTable() takes a single matrix, mat. By default, it returns a LaTeX macro that creates a well-formatted LaTeX table.

## Usage

```
latexTable(
  mat,
  SE_table = TRUE,
  headerFooter = TRUE,
  commandName = "myTable",
  callCommand = TRUE,
  label = commandName,
  floatPlacement = "p",
  landscape = if (SE_table) ncol(mat)/2 >= 6 else ncol(mat) >= 6,
  starredFloat = FALSE,
  horizOffset = "-0in",
  rowNames = rownames(mat),
  footerRows = lt_footer(),
  colNames = lt_colNames_default(),
  colNameExpand = FALSE,
  extraRowHeight = if (SE_table) "2pt" else "4pt",
  spacerColumns = lt_spacerColumns_default(),
  spacerColumnsWidth = ".67em",
  spacerRows = NULL,
  spacerRowsHeight = ".15in",
  tabColSep = "2.75pt",
  spaceBetweenColNameRows = "-.025in",
  columnTierSeparator = " ",
  printCaption = TRUE,
  caption = paste0(label, " caption goes here."),
  captionMargins = NULL,
  formatNumbers = TRUE,
  decimalPlaces = 2,
  SE_fontSizeString = "\\fontsize{10.3bp}{10.3bp}\\selectfont",
  NA_text = "",
  clipboard = FALSE
)
```

## Arguments

mat	Matrix of numbers to be displayed in a LaTeX table.
SE_table	Logical variable that indicates whether mat contains pairs (or "tiers") of columns, with the first column in each pair containing estimates, and the second column containing standard errors. Defaults to TRUE. If TRUE, the even-numbered columns of mat will be rendered in smaller type than the odd-numbered columns. That is, the standard errors will be rendered in smaller type than their corresponding estimates. This default type sizing can be overridden by the SE_fontSizeString argument.
headerFooter	Logical variable. If TRUE, which is the default, the output will be (or at least include) a LaTeX macro that generates a table. For example, you will be able to produce a table simply by calling <code>\myTable{p}</code> or <code>\myTable{h}</code> in your master LaTeX document. If headerFooter is FALSE, the only output of the function will be LaTeX code for "data rows"—one row for each row of mat.
commandName	A string. It is the name of the macro that produces the LaTeX table (if headerFooter

	is TRUE). By default, it is "myTable"; you can change it to something more descriptive, e.g., "mainEstimates".
callCommand	Logical variable. Should the last line of the latexTable object be a call to the macro that creates the table? If callCommand is TRUE, which is the default, sourcing a file that contains latexTable output—that is, by using <code>\input</code> or <code>\include</code> in your master LaTeX document—will produce a table when that master LaTeX document is rendered. If callCommand is FALSE, sourcing the file will make the macro available in your LaTeX document, but it won't call the macro. (You will need to call the macro yourself by adding a line like <code>\myTable{p}</code> to your LaTeX document.)
label	A string. Specifies the LaTeX label for a table. It is not printed anywhere in the table, but references to the figure in your LaTeX document (for example, references created by <code>\ref</code> or <code>\autoref</code> ) must include the label name. For simplicity, the default label is the same as the commandName argument.
floatPlacement	Character vector of length 1. Acceptable values are p (the default, which places each table on its own page), h, H, t, b, and !. See the <a href="#">LaTeX wikibook</a> for more on float placement in LaTeX.
landscape	Logical variable. Determines whether the table is printed in landscape or in portrait mode. Affects the output only if if headerFooter == TRUE and callCommand == TRUE.
starredFloat	Logical variable that indicates whether the LaTeX table should be specified with <code>table*</code> instead of <code>table</code> . The default is FALSE, but you may want to set it to TRUE if you want you are using a multi-column page layout in LaTeX and want the table to cross both columns.
horizOffset	A string that specifies a LaTeX length, e.g., ".25in". When the LaTeX code produced by latexTable is rendered, the table will be moved to the right by this length (or to the left if the length is negative, e.g., "-.25in").
rowNames	Character vector of labels for the rows in mat. The labels will be printed to the left of each row in mat. rowNames can be NULL.
footerRows	List, object that can be coerced to a list, or a function that creates a list. Each element in the list is a character vector that specifies entries for a row of the footer. The default is <code>lt_footer()</code> , which typically provides a "Number of observations" row. If a model is of class "lm," it will also provide an $R^2$ and "Std. error of regression" row. The first entry in each footerRows list-element should be the row name for the corresponding footer row (e.g., '\$F\$', '\$R^2\$'). If SE_table is FALSE, each entry after the footer row name will be centered in its column. If SE_table is TRUE (the default), each entry after the footer row name will be horizontally centered in its column tier. See the documentation of the SE_table parameter for more on column tiers.
colNames	List, or object that can be coerced to a list, of column headings. Typically, each element in the list is a character vector, and the elements of the character vector specify the names of the table's columns.

If `SE_table` is `TRUE` (the default), each column name will appear over a pair of columns. In this case, each element in the `colNames` list should contain `ncol(mat)/2` entries.

To specify multi-line column labels, use a list with multiple elements. The entries in the first list element will then appear in the top row of the column label, the entries in the second list element will appear in the next row of the column label, and so on.

By default, column names will be taken from `colnames(mat)`. If `colnames(mat)` is `NULL`, columns will be numbered "(1)", "(2)", etc. See `lt_colNames_default()` for more information.

**colNameExpand** Logical variable. By default, an entry of "" in a `colNames` list element—that is, an empty entry—indicates that a column should have no column heading. But if `colNameExpand` is `TRUE` and a text entry in a `colNames` list element is followed by one or more "" entries, the column name specified by the text entry will bridge the columns that have "" entries.

`colNameExpand` and `spacerColumns` do not play well together. If you run `latexTable` with `colNameExpand == TRUE` and a non-`NULL` `spacerColumns` argument, you will get LaTeX output, but you will probably need to edit the `"\multicolumn"` and `"\cmidrule"` commands in the output so that LaTeX can render the output.

**extraRowHeight** A string that specifies a length that LaTeX recognizes, e.g., `'2pt'` or `'.25in'`. The `extrarowheight` length in LaTeX will be set to `extraRowHeight`. In practice, this means that the vertical space between every row will be increased by `extraRowHeight`. This argument has no effect if `headerFooter` is `FALSE`.

**spacerColumns** A vector of integers. Specifies columns in `mat` after which to insert columns that contain no entries. These "spacer columns" are used to insert horizontal space into the typeset table. By default, `spacerColumns` are specified by a helper function, `spacerColumns_default()`:

- If `SE_table` is `FALSE`, there is a spacer column between every column in `mat`.
- If `SE_table` is `TRUE`, there is a spacer column after every even-numbered column in `mat`, except for the last column.
- If `rowNames` is not `NULL`, a spacer column is inserted between the table's row names and the first column of data.

To add a `spacerColumn` between the rownames and the first data column, make 0 one of the values in `spacerColumns`.

`colNameExpand` and `spacerColumns` do not play well together. If you run `latexTable` with `colNameExpand == TRUE` and a non-`NULL` `spacerColumns` argument, you will get LaTeX output, but you will probably need to edit the `"\multicolumn"` and `"\cmidrule"` commands in the output so that LaTeX can render the output.

See the end of the **Building better tables in less time** vignette for a technical note on `spacerColumns` and column spacing in LaTeX.

**spacerColumnsWidth**

Either a single string of a recognizable LaTeX length (e.g., `'.5em'`) or a character vector indicating the width of each spacer column. Has no effect unless `headerFooter` is `TRUE`.

spacerRows	A vector of integers. After each row in <code>mat</code> whose number is in <code>spacerRows</code> , a vertical space of <code>spacerRowsHeight</code> will be printed. For example, if <code>spacerRows == c(2, 4)</code> , a vertical space will be added after rows 2 and 4 of <code>mat</code> .
spacerRowsHeight	A string that specifies a recognizable LaTeX length, e.g., <code>".15in"</code> .
tabColSep	Character vector indicating a length that LaTeX recognizes, e.g., <code>".25in"</code> . The <code>tabcolsep</code> value in LaTeX will be set to this value if <code>headerFooter</code> is <code>TRUE</code> . If <code>SE_table</code> is <code>TRUE</code> , <code>tabColSep</code> will be the default distance between the estimate and the SE column in each column pair, and it will be half of the distance between column pairs. If <code>SE_table</code> is <code>FALSE</code> , <code>tabColSep</code> will simply be half of the default distance between columns. These distances between columns can be increased by the <code>spacerColumns</code> argument.
spaceBetweenColNameRows	String specifying a LaTeX length, e.g., <code>".025in"</code> (the default). When column names are to be split across multiple rows, a vertical space of this length will be inserted between the rows.
columnTierSeparator	A string. In the LaTeX code generated by <code>latexTable</code> , all columns are separated from each other by <code>" &amp; "</code> . Column tiers – that is, pairs of columns giving the estimate and the SE for a particular coefficient – are further separated by <code>columnTierSeparator</code> , which defaults to two spaces ( <code>' '</code> ). This option affects only the LaTeX code produced by <code>latexTable</code> ; it exists to make the LaTeX code more readable. It does not affect the typeset (e.g., PDF) version of the table.
printCaption	Logical variable.
caption	A string. It can include LaTeX commands, e.g., <code>"\\textit{Results from a minimal specification}"</code> . It can also include references to other labeled parts of your LaTeX document, e.g., <code>"\\autoref{SomeFigure}"</code> . See the examples.
captionMargins	A vector of two strings that specify the margins of the caption. The strings should be LaTeX lengths, e.g., <code>".25in"</code> or <code>".67em"</code> . By default, <code>captionMargins</code> is <code>NULL</code> .
formatNumbers	<p>Logical variable, <code>TRUE</code> by default. Pretty-print the entries in <code>mat</code> by:</p> <ul style="list-style-type: none"> <li>• Rounding all entries to the <code>decimalPlaces</code> digit.</li> <li>• Padding out entries with trailing zeroes. For example, 3 will become <code>3.00</code> if <code>decimalPlaces == 2</code>.</li> <li>• Removing leading zeroes. For example, <code>0.12</code> will become <code>.12</code>.</li> </ul> <p>If <code>formatNumbers</code> is <code>FALSE</code>, formatting of entries in <code>mat</code> will be handled by <code>print.default()</code>.</p>
decimalPlaces	Integer. If <code>formatNumbers</code> is <code>TRUE</code> , table entries will be shown to this decimal place. For example, if <code>decimalPlaces==2</code> , both <code>"3.0035"</code> and <code>"3"</code> will become <code>"3.00"</code> .



If `formatNumbers` is `FALSE`, entries will not be adjusted, but `decimalPlaces` will still be used to determine the widths of columns and some aspects of column spacing. For example, even if `formatNumbers` is `FALSE`, data columns will be wider when `decimalPlaces` is 10 than when it is 2.

`SE_fontSizeString`

A string. Indicates how standard errors are to be formatted when `SE_table` is `TRUE`. Defaults to `\\fontsize{10.3bp}{10.3bp}\\selectfont`, which renders standard errors in slightly smaller type than the corresponding estimates.

`NA_text`

A string. NA entries in `mat` will be replaced by the string.

`clipboard`

Logical variable. Copy entire output to clipboard. Useful if you want to paste the output directly into a `.tex` file. Works only on Windows.

## Value

An object of classes `latexTable` and `character`. The returned object is a vector of strings of LaTeX code; each string is a line in a LaTeX macro that can create a table.

There is one small exception. If `callCommand` is `TRUE`, the last line is not part of the macro; instead, it calls the macro, thereby telling LaTeX to display the table. For example, if `commandName` and `label` are `myTable`, and if `callCommand` is `TRUE`, the last line of the returned object is `\mytable{p}`.

## Note

*Required LaTeX packages.* The LaTeX code produced by the `latexTable` makes use of capabilities provided by the `booktabs`, `caption`, `float`, `numprint`, and `ragged2e` LaTeX packages—and, for landscaped tables, the `pdflscape` package. If you haven't installed those LaTeX packages, you won't be able to render the tables produced by `latexTable`.

The LaTeX code produced by `latexTable` also makes use of capabilities provided by the `array` and `afterpage` LaTeX packages—but these packages are **included** in every LaTeX distribution.

*Changes from pre-release versions:*

- The names of some arguments have changed slightly since the pre-release versions of this function. They have been changed to enforce consistency: `camelCase` is used for all arguments, and every acronym is followed by an underscore (`_`) character. We thus have `SE_table` instead of `SEtable`, `tabColSep` instead of `tabcolsep`, and so on.
- The `hspace` argument has been renamed to `horizOffset`.
- Some default arguments have changed. In particular, the default `spacerColumns` argument is no longer `NULL`. Instead, the default is to insert spacer columns in appropriate places. See documentation of the `spacerColumns` argument for details.

## See Also

Other functions for making tables: `regTable()`, `latexTablePDF()`. See also the **Building better tables in less time** vignette.

## Examples

```
data(iris)
lm1 <- lm(Sepal.Length ~ Petal.Length, data = iris)
lm2 <- lm(Sepal.Length ~ Petal.Length + Petal.Width, data = iris)
lm3 <- lm(Sepal.Length ~ Petal.Length * Petal.Width, data = iris)
rT1 <- regTable(list(lm1, lm2, lm3))
latexTable(rT1)
latexTable(rT1, SE_table = FALSE, colNames = lt_colNumbers())
lt2 <- latexTable(
  mat = rT1,
  colNames = list(qw("model model model"), qw("1 2 3")))
lt3 <- latexTable(
  mat = rT1,
  colNames = lt_colNumbers(),
  rowNames = c(
    "Intercept",
    "Petal length",
    "Petal width",
    "Petal length  $\times$  petal width"),
  footerRows = list(lt_nobsRow(), lt_rSquaredRow()),
  commandName = 'mainEstimates',
  caption = "Each entry is an estimate or a standard error from a separate OLS regression.")
lt4 <- update(
  lt3,
  commandName = 'myEstimates', # change name of LaTeX macro
  spacerRows = 1, # add vertical space after intercept row
  footerRows = list(
    c("My first footer row", "a", "b", "c"),
    c("My second footer row", "Lorem", "ipsum", "dolor")
  ))
```

---

latexTablePDF

*Renders a LaTeX table as a PDF file.*

---

## Description

latexTablePDF() takes an object produced by [latexTable\(\)](#) and writes a PDF file. It can also write the corresponding .tex file.

## Usage

```
latexTablePDF(
  latexTable,
  container = TRUE,
  containerFilename = "tableContainer.tex",
  outputFilenameStem = "latexTable",
  writePDF = TRUE,
  writeTex = FALSE,
  overwriteExisting = FALSE,
  verbose = FALSE,
  continuedFloat = FALSE,
  continuedFloatStar = FALSE,
  firstPageEmpty = TRUE,
```

```

    firstTableNumber = NULL,
    openPDFOnExit = TRUE
)

```

## Arguments

latexTable	Object of class latexTable (typically produced by latexTable()) or a list of such objects.
container	Logical variable. Should the LaTeX code in latexTable be inserted into a LaTeX file that contains a complete LaTeX preamble and the \begin{document} and \end{document} tags? If you want latexTablePDF to produce a PDF file, container must be TRUE. But if you just want to write latexTable to disk as a .tex file that you will insert into your own larger LaTeX document, container should probably be FALSE.
containerFilename	A string. Specifies the path of the "container" LaTeX file into which the latexTable table or tables will be inserted to make a complete LaTeX file that can be rendered as PDF. By default, it is "tableContainer.tex", which is included in this package.
outputFilenameStem	A string. It is the path and name of the file is to be saved to disk, up to the extension. For example, if you want to save "myTable.pdf" to disk, set outputFilenameStem = "mytable".
writePDF	Logical variable. Should a PDF file be saved to disk?
writeTex	Logical variable. Should a .tex file be saved to disk?
overwriteExisting	Logical variable. Should files to be saved overwrite existing files that have the same names?
verbose	Logical variable. latexTablePDF calls pdflatex to render PDF files, and if verbose is TRUE, all of the output from pdflatex will be printed to screen. Useful for debugging.
continuedFloat	Logical variable. Should be TRUE if the table or tables to be rendered are part of a series and should all share the same number. For example, continuedFloat should be true if latexTable is a list of tables and you all want them to be numbered as Table 3.
continuedFloatStar	Logical variable. Should be TRUE if the table or tables to be rendered are part of a series, and if all tables should share the same number but be distinguished by some secondary character. For example, continuedFloatStar should be true if latexTable is a list of tables and you all want them to be numbered as Table 3a, Table 3b, etc. continuedFloat and continuedFloatStar cannot both be TRUE.
firstPageEmpty	Logical variable. If TRUE, the page that contains the first table in latexTable will have an empty header and footer. (Technically, latexTablePDF will insert \thispagestyle{empty} into the code block that contains the first table in latexTable.)

firstTableNumber

Integer. What number should the first table in latexTable have?

By default, the table numbering will be "natural." That is, the number of the first latexTable table will be determined by the number of preceding tables in the document. For example, if you use latexTablePDF() to create a .tex file that you then insert into a larger LaTeX document, and if the .tex file is preceded in the LaTeX document by two tables, the first table created by latexTable() will be Table 3.

openPDFOnExit Logical variable. Open the PDF file after it is created by latexTablePDF? This argument has an effect only on Windows, and only if writePDF is TRUE.

## Details

Although latexTablePDF produces PDF files by default, it is also useful for creating .tex files. For example, you may have a list of tables produced by latexTable() and a complex LaTeX document that contains many different sections and tables. When latexTablePDF is used with writeTex = TRUE, it will produce a single file that contains LaTeX code for all of the tables in your list. You can then insert those tables into your LaTeX document by adding a single \input or \include command to your LaTeX document. For details, see vignette("tables", package = "Bullock").

## Note

*Required LaTeX tools.* If writePDF is FALSE, you do not need to have LaTeX installed. But if writePDF is TRUE:

- pdflatex must be installed on your system. It is part of almost every LaTeX installation. The array and afterpage packages must also be installed; if you have a LaTeX installation, you already have these packages.
- The booktabs, caption, and numprint must be installed.
- If containerFilename is "tableContainer.tex" (the default), the fancyhdr, footmisc, geometry, and ragged2e packages must be installed.
- If you are producing a landscape table, the pdfscape package must be installed.
- If your latexTable() output was produced with floatPlacement = 'H', the float package must be installed.

## See Also

Other functions for making tables: [latexTable\(\)](#), [latexTablePDF\(\)](#). See also the [Building better tables in less time](#) vignette.

## Examples

```
## Not run:
data(iris)
lm1 <- lm(Sepal.Length ~ Petal.Length, data = iris)
lm2 <- lm(Sepal.Length ~ Petal.Length + Petal.Width, data = iris)
lm3 <- lm(Sepal.Length ~ Petal.Length * Petal.Width, data = iris)
lmList <- list(lm1, lm2, lm3)
```

```

rT1 <- regTable(lmList)
lT1 <- latexTable(
  mat          = rT1,
  colNames     = lt_colNumbers(),
  rowNames     = c(
    "Intercept",
    "Petal length",
    "Petal width",
    "Petal length  $\times$  petal width"),
  footerRows = list(lt_nobsRow(), lt_rSquaredRow()),
  spacerRows = 1, # insert white space between Intercept row and other rows
  caption     = paste0(
    "\\textit{Sepal length as a function of petal length and petal width.} ",
    "Entries are estimates and standard errors from OLS regressions..."
  )
)
latexTablePDF(lT1, outputFilenameStem = "irisData")

# Create a PDF or .tex file that contains two tables:
lm1v <- update(lm1, subset = (Species == 'versicolor'))
lm2v <- update(lm2, subset = (Species == 'versicolor'))
lm3v <- update(lm3, subset = (Species == 'versicolor'))
rT2 <- regTable(list(lm1v, lm2v, lm3v))
lT2 <- update(lT1, mat = rT2, commandName = "tableVersicolor")

latexTablePDF(                                # PDF with two pages
  lT2,
  outputFilenameStem = "irisData_twoTables")
latexTablePDF(                                # add .tex file with code for two tables
  lT2,
  outputFilenameStem = "irisData_twoTables",
  writeTex           = TRUE)

## End(Not run)

```

---

lt\_colNames\_default      *Compute default column names for latexTable objects.*

---

## Description

If `colnames(mat)` is not NULL, this function will use `colnames(mat)` as the `colNames` argument in `latexTable()`. If `colnames(mat)` is NULL, column names will be determined by [lt\\_colNumbers\(\)](#).

## Usage

```

lt_colNames_default(
  mat = parent.frame()$mat,
  SE_table = parent.frame()$SE_table
)

```

## Arguments

`mat`                      A matrix, typically a `regTable` object.

`SE_table`                Logical variable. See [latexTable\(\)](#).

**Details**

The function is not exported and is intended to be called only by `latexTable()`.

**Value**

A vector of strings. Each string is a column name.

---

lt_colNumbers	<i>Automatically determine column names of the form (1), (2), etc.</i>
---------------	--

---

**Description**

Given `mat` and `SE_table`, this function determines appropriate column-number names of the form "(1)", "(2)", etc.

**Usage**

```
lt_colNumbers(mat = parent.frame()$mat, SE_table = parent.frame()$SE_table)
```

**Arguments**

<code>mat</code>	A matrix, typically a <code>regTable</code> object.
<code>SE_table</code>	Logical variable. See <code>latexTable()</code> .

**Value**

A vector of strings. If `SE_table` is `TRUE`, the vector elements are "(1)", "(2)", etc., where the last column number is `ncol(mat)/2`. If `SE_table` is `FALSE`, the vector elements are "(1)", "(2)", etc., where the last column number is simply `ncol(mat)`.

---

lt_footer	<i>Compute default footers for <code>latexTable()</code> objects.</i>
-----------	---

---

**Description**

The default footer row or rows are determined in this way: if `SE_table` is `FALSE` or `rowNames` is `NULL`, no footer rows are produced. Otherwise, a footer row will be added for each of the following attributes of `mat`: "r.squared", "SER", and "N". If `mat` lacks one of those attributes, there will be no corresponding footer row. The function is not exported and is intended to be called only by `latexTable()`.

**Usage**

```
lt_footer(
  mat = parent.frame()$mat,
  rowNames = parent.frame()$rowNames,
  SE_table = parent.frame()$SE_table,
  decimalPlaces = parent.frame()$decimalPlaces
)
```

**Arguments**

mat	A matrix, typically a regTable object.
rowNames	Character vector. See <a href="#">latexTable()</a> .
SE_table	Logical variable. See <a href="#">latexTable()</a> .
decimalPlaces	Integer. See <a href="#">latexTable()</a> .

**Value**

A list of string vectors. Each list element contains the strings needed to produce a footer row.

---

lt_nobsRow	<i>Specify a footer row that indicates the number of observations for each regression.</i>
------------	--

---

**Description**

Given a mat produced by [regTable\(\)](#), this function returns a footer row that indicates the number of observations for each model in mat.

**Usage**

```
lt_nobsRow(mat = parent.frame()$mat)
```

**Arguments**

mat	A regTable object.
-----	--------------------

**Value**

A vector of strings. The first element in the vector is "Number of observations". The remaining elements are the numbers of observations for each regression in mat.

---

lt_rSquaredRow	<i>Specify a footer row that indicates <math>R^2</math> for each regression.</i>
----------------	--

---

**Description**

Given a mat produced by [regTable\(\)](#) in which all regressions are of class lm, this function returns a footer row that indicates  $R^2$  for each model in mat.

**Usage**

```
lt_rSquaredRow(
  mat = parent.frame()$mat,
  decimalPlaces = parent.frame()$decimalPlaces
)
```

**Arguments**

`mat`                      A matrix, typically a `regTable` object.

`decimalPlaces`      Integer. See [latexTable](#).

**Value**

A vector of strings. The first element in the vector is "R<sup>2</sup>". The remaining elements are strings that indicate  $R^2$  for each model in `mat`. The strings are rounded to the number of digits specified by the `decimalPlaces` argument.

---

lt_SER_row	<i>Specify a footer row that indicates the standard error of regression for each model</i>
------------	--

---

**Description**

Given a `mat` produced by [regTable\(\)](#) in which all regressions are of class `lm`, this function returns a footer row that indicates the standard error of regression (i.e.,  $\sigma$ , the "residual standard error") for each model in `mat`.

**Usage**

```
lt_SER_row(
  mat = parent.frame()$mat,
  decimalPlaces = parent.frame()$decimalPlaces
)
```

**Arguments**

`mat`                      A matrix, typically a `regTable` object.

`decimalPlaces`      Integer. See [latexTable](#).

**Value**

A vector of strings. The first element in the vector is "Std. error of regression". The remaining elements are strings that indicate the SER for each model in `mat`. The strings are rounded to the number of digits specified by the `decimalPlaces` argument.



---

lt\_spacerColumns\_default

*Compute default positions of spacer columns in calls to latexTable().*


---

### Description

spacerColumns\_default specifies the default spacerColumns argument in calls to latexTable. It takes the values of mat, SE\_table, and rowNames that are passed to latexTable. From these values, it computes the default positions of spacer columns:

- If SE\_table is FALSE, there is a spacer column between every column in mat.
- If SE\_table is TRUE, there is a spacer column after every even-numbered column in mat, except for the last column.
- If rowNames is not NULL, a spacer column is inserted between the table's row names and the first column of data.

### Usage

```
lt_spacerColumns_default(
  mat = parent.frame()$mat,
  SE_table = parent.frame()$SE_table,
  rowNames = parent.frame()$rowNames
)
```

### Arguments

mat	Matrix.
SE_table	Logical variable.
rowNames	Vector.

### Details

The function is not exported and is intended to be called only by `latexTable()`.

### Value

A vector of integers.

---

mergeFac

*Fill in missing values of one factor with corresponding values from another.*


---

### Description

Given a factor of length n that contains some missing values, fill in the missing values with the corresponding values of others factors.

### Usage

```
mergeFac(x, ...)
```

**Arguments**

<code>x</code>	Factor variable.
<code>...</code>	Other factor variables.

**Details**

`x` and the factors named in `otherFactors` must all have the same length. If they do, missing values in `x` will be filled in with the corresponding values of the first factor in `otherFactors`. If the corresponding values of that factor are also missing, `mergeFac()` will look to the corresponding values of the next factor, and so on.

**Note**

Merging factors in this way is trickier than just using a command like `fac1[is.na(fac1)] <- fac2[is.na(fac1)]` because `fac1` and `fac2` may have different factor levels. This commands takes care of the problem by merging the levels among different factors.

**Examples**

```
fac1 <- factor(c("a", NA, "b", NA, NA))
fac2 <- factor(c("y", "y", "y", NA, NA))
fac3 <- factor(c(NA, "z", "z", "z", NA))
mergeFac(fac1, fac2)      # [1] a    y    b    <NA> <NA>
mergeFac(fac1, fac2, fac3) # [1] a    y    b    z    <NA>
```

---

`missingPackageString`    *Checks for existence of required LaTeX packages.*

---

**Description**

The code produced by `latexTable()` can be rendered only if certain LaTeX packages are installed. (See the note at the end of the [latexTablePDF\(\)](#) help file for details.) If packages are missing, this function generates an informative string that can be used in warning or error messages.

**Usage**

```
missingPackageString(
  installedPackageList,
  requiredPackageList,
  writePDF,
  writeTex
)
```

**Arguments**

<code>installedPackageList, requiredPackageList</code>	Character vectors.
<code>writePDF, writeTex</code>	Logical variables. See the <a href="#">latexTable()</a> documentation for further information about these arguments.

**Details**

This function is not exported. It is called by `latexTablePDF()` only if packages are missing. It generates either an error (if `writePDF` is `TRUE`) or a warning (if `writePDF` is `FALSE` but `writeTex` is `TRUE`).

---

`missingValueFunctions` *Missing-value helper functions.*

---

**Description**

Functions to make code a little clearer. These are mainly ordinary functions, like `mean()`, with `na.rm` set to `TRUE`. For example, `meanNA()` is defined as `function(x) mean(x, na.rm = TRUE)`.

**Usage**

```
lNA(x, verbose = FALSE)
```

```
lNAv(x)
```

```
meanNA(x)
```

```
sdNA(x)
```

```
sumNA(x)
```

```
varNA(x)
```

**Arguments**

<code>x</code>	An R object.
<code>verbose</code>	Logical variable. If <code>TRUE</code> , <code>lNA</code> will print the lengths of <code>x</code> before and after NA values have been removed.

**Details**

`lNA(x)` returns its value silently. `lNAv` is shorthand for `lNA(x, verbose = TRUE)`; it returns the same value as `lNA(x)` but also prints the lengths of the vector before and after NAs are removed.

**Examples**

```
lNA(NA)      # 0

x <- c(1:3, NA, 5)
lNA(x)       # 4
lNAv(x)      # 4 (length with NA=5)

sum(NA)      # NA
sumNA(NA)    # 0

sum(x)       # NA
sumNA(x)     # 11
meanNA(x)    # 2.75
```

```
sdNA(x)
varNA(x)
```

---

modalValue	<i>Find modal value of a vector.</i>
------------	--------------------------------------

---

### Description

Find modal value of a vector. If there are multiple modal values, all will be returned.

### Usage

```
modalValue(x, na.rm = FALSE)
```

### Arguments

x	Vector.
na.rm	Logical variable.

### Details

Before this package was released, it returned only the first mode if there were multiple modes. It now returns all modes. See the examples.

### Author(s)

Ken Williams. See <http://stackoverflow.com/a/8189441/697473>.

### Examples

```
modalValue(qw("a b b"))      # [1] "b"
modalValue(qw("a a b b c"))  # [1] "a" "b"
modalValue(1:3)               # [1] 1 2 3
```

---

moveToDF	<i>Move or copy "freestanding" variables into a data frame.</i>
----------	---

---

### Description

Variables are specified by pattern, which is a regular expression. The modal length of all variables in the calling environment that match pattern is determined. Matching variables are then moved to a data frame (or copied to a data frame if move is FALSE). pattern may be NULL, in which case all variables in the calling environment will be examined.

### Usage

```
moveToDF(pattern = NULL, move = TRUE)
```

**Arguments**

pattern	String that specifies a regular expression. It is NULL by default, in which case all variables in the environment are examined for inclusion in the data frame.
move	Logical variable.

**Details**

If there are multiple modal lengths of the objects in the calling environment, all modes will be used. For example, if the calling environment has 20 objects of length 1, 20 objects of length 2, and one object of length 3, the returned data frame may have as many as 40 columns.

Variables that have the "dim" attribute – for example, arrays and matrices – will not be moved into the new data frame. Functions will never be moved into the new data frame, either.

**Value**

Data frame containing all one-dimensional variables that have names matching pattern and that have the modal length of those variables.

---

PDF_crop	<i>Crop white margins of a PDF file.</i>
----------	--

---

**Description**

PDF\_crop() removes ("crops") the white margins around a PDF. It requires that pdfcrop.exe be installed and in your path. To get pdfcrop.exe, install MikTeX or Tex Live, or just use `tinytex::tlmgr_install('pdftocrop')`.

**Usage**

```
PDF_crop(
  input,
  dirOutput = NULL,
  outputExtension = "_crop",
  deleteOriginal = TRUE,
  openCropped = FALSE,
  verbose = FALSE
)
```

**Arguments**

input	A string. Path and name of file to be cropped. If input does not end with ".pdf", ".pdf" will be appended to it. This is the only required argument.
dirOutput	A string. Path of directory into which cropped file should be placed.
outputExtension	A string. The new file will have the same name as the old file, except that outputExtension will be inserted just before the ".pdf" extension.
deleteOriginal	Logical, defaulting to TRUE. Should the original file be deleted?
openCropped	Logical, defaulting to FALSE. After the new file is produced, should it be opened in your default PDF viewer? Ignored on non-Windows, non-Macintosh systems.

**verbose** Logical, defaulting to FALSE. If it is TRUE, two lines of information from pdfcrop.exe will be printed. They will show your version of pdfcrop.exe, the number of pages in the file that it produced, and the path and filename of the file that it produced.

### See Also

`knitr::plot_crop()`, which is less flexible in its handling of PDF files but can handle other file formats.

### Examples

```
tmpFile <- tempfile(fileext = ".pdf")
pdf(tmpFile)
  plot(1:10, 1:10)
dev.off()
PDF_crop(tmpFile)
```

---

print.regTable	<i>Print regTable objects.</i>
----------------	--------------------------------

---

### Description

`print.regTable()` is the default print method for objects produced by `regTable()`. The output that it produces differs from `print.table()` output because `print.regTable()`

- right-aligns row names;
- inserts one space between each estimate and SE column, but two spaces between estimate-SE column tiers, thereby making it easier to distinguish between results from different regressions;
- uses two rows of column headings: one to show the outcome for each regression, and another to distinguish columns of coefficient estimates from columns of SE estimates;
- does not print attributes (e.g., "N", "r.squared").

### Usage

```
## S3 method for class 'regTable'
print(x, decimalPlaces = getOption("Bullock.print.regTable.dp"), ...)
```

### Arguments

<b>x</b>	regTable object.
<b>decimalPlaces</b>	Integer. Table entries will be rounded to this number of digits after the decimal point. By default, it is the value of <code>getOption("Bullock.print.regTable.dp")</code> , which is set to 2 when the Bullock package is loaded. You can change the default by running <code>options("Bullock.print.regTable.dp") &lt;- N</code> at any time, where N is your preferred number of digits after the decimal place.
<b>...</b>	Arguments passed to <code>print.table()</code> .

qw

*Perl-like qw() function for quoting a list of words***Description**

qw takes a string of words separated by spaces. It returns a vector in which each element is a word. The point of the function is to speed the creation of vectors of words.

**Usage**

```
qw(x)
```

**Arguments**

x                      character string

**Value**

Character vector.

**Author(s)**

Florent Delmotte

**References**

Code taken from post by Florent Delmotte (“flodel”) at <http://stackoverflow.com/questions/520810/>.

**Examples**

```
qw("You can type    text here
   with    linebreaks if you
   wish")
# [1] "You"      "can"      "type"     "text"
# [5] "here"     "with"     "linebreaks" "if"
# [9] "you"      "wish"
```

regTable

*Create a matrix of regression output from a list of regression models.***Description**

regTable() takes a list of regression objects, such as those created by lm(). It returns a matrix in which the columns are estimates and standard errors – two columns for each model. Together, the two columns that represent a regression are a *column-pair* or a *column-tier*.

**Usage**

```
regTable(
  objList,
  colNames = NULL,
  rowsToRemove = NULL,
  rowsToKeep = NULL,
  clusterVar = NULL
)
```

**Arguments**

<code>objList</code>	List of regression objects. This is the only required argument. <code>regTable()</code> has been tested with objects of classes <code>ivreg</code> , <code>glm</code> , <code>lm</code> , and <code>plm</code> , and with the objects produced by the <code>estimatr</code> package. It should work with other regression objects, too – that is, with any regression objects for which the <code>coef()</code> and <code>vcov()</code> functions can be used.
<code>colNames</code>	A vector of strings as long as <code>length(objList)</code> .
<code>rowsToRemove</code>	A vector of strings, which may specify regular expressions. Variables in the regressions whose names match the strings will be omitted from the <code>regTable</code> output. This argument overrides <code>rowsToKeep</code> .
<code>rowsToKeep</code>	A vector of strings, which may specify regular expressions. Variables in the regressions whose names match the strings will be kept in the <code>regTable</code> output. All other variables will be omitted. If <code>rowsToRemove</code> is specified, this argument has no effect.
<code>clusterVar</code>	Either <code>NULL</code> , a list of length 1, or a list of length <code>length(objList)</code> . If <code>NULL</code> (the default), <code>regTable()</code> will report the standard errors indicated by your regression objects. Otherwise, the argument to <code>clusterVar</code> should indicate the clusters for the corresponding regression objects in <code>objList</code> . Clustered SEs for "lm" objects will be produced by <code>multiwayvcov::cluster.vcov</code> , and clustered SEs for "ivreg" objects will be produced by <code>ivpack::cluster.robust.se</code> . <code>regTable()</code> does not support clustering for other kinds of regression objects.

**Value**

A matrix in which the columns are estimates and standard errors – two columns for each model. The matrix has an "N" attribute that indicates the number of observations for each regression. If all regressions were of class `lm` (but not also class `glm`), it also has the "r.squared" and "SER" attributes. (The "SER" attribute indicates the standard error of regression – AKA  $\sigma$  or the "residual standard error" — for each model.)

**Subsetting regTable objects with the [ operator**

You can take subsets of `regTable` objects with the `[` operator. It subsets intelligently. That is, it knows whether the subsetted object contains only intact column tiers, and it modifies the class and attributes of the subsetted object accordingly. To wit:

- If you remove only certain column-pairs from your original `regTable` object, such that the remaining columns all form intact column-pairs, all attributes for the remaining column-tiers are preserved. For example, the `N` and `r.squared` attributes are preserved. In other words, the `[` operator knows which regressions you have removed from the table, and it removes attribute information for only those regressions.



- If you remove only rows from your original `regTable` object, all attributes are preserved. This result has the potential to be misleading: for example, you may remove a row that reports information for a given predictor, but the `N`, `r.squared`, and `SER` attributes were all computed from regressions that included that predictor. Consequently, a message will be printed to remind you that the attributes have been preserved.
- If you remove columns from your original `regTable` object such that the remaining columns do *not* all form intact column-pairs, the `N`, `r.squared`, and `SER` attributes are stripped, and the returned object is a matrix without the "regTable" class.

See the examples for an illustration.

### Change from the pre-publication version

Before `regTable()` was incorporated into this package, it used the `rowsToKeep` argument differently: variables were kept only if the *beginnings* of their names matched the strings in `rowsToKeep`.

### See Also

Other functions for making tables: `latexTable()`, `latexTablePDF()`. See also the [Building better tables in less time](#) vignette.

### Examples

```
data(iris)
lm1 <- lm(Sepal.Length ~ Petal.Length, data = iris)
lm2 <- lm(Sepal.Length ~ Petal.Length + Petal.Width, data = iris)
regTable(list(lm1, lm2))
regTable(list(lm1, lm2), colNames = c("Sepal length", "Sepal width"))
regTable(list(lm1, lm2), rowsToKeep = 'Length')
regTable(list(lm1, lm2), rowsToKeep = c('Intercept', 'Length'))
regTable(list(lm1, lm2), clusterVar = list(iris$Species))

# illustrate subsetting
rT <- regTable(list(lm1, lm2))
ncol(rT) # 4
attributes(rT)$N # 150 150
rT2 <- rT[1:2, ]
attributes(rT2)$N # 150 150
rT3 <- rT[, 3:4]
attributes(rT3)$N # 150
rT4 <- rT[, 2:3]
attributes(rT4)$N # NULL
class(rT4) # "matrix"
```

---

reliability

---

*Compute Cronbach's alpha for a battery of items.*


---

### Description

Compute Cronbach's alpha for a battery of items, and show the reliability for all different batteries that might be created by removing one item from the original battery.

**Usage**

```
reliability (x, ...)
```

**Arguments**

`x`                      Matrix of measurements, e.g., survey responses. Cannot have missing data.

`...`                    Arguments to be passed to `alpha.cronbach()`. Currently serves no function.

**Author(s)**

Peter Ellis

---

rescale	<i>Rescale a vector to have a specified minimum and maximum.</i>
---------	--

---

**Description**

Rescale a vector to have a specified minimum and maximum.

**Usage**

```
rescale(x, newRange = c(0, 1))
```

**Arguments**

`x`                      Numeric object.

`newRange`              Numeric vector of length 2.

**Author(s)**

Simon D. Jackman

**See Also**

[scale\(\)](#) and [scales::rescale\(\)](#)

**Examples**

```
vec <- 1:10
rescale(vec, c(2, 5))
```

---

stackUtilities*Perl-like stack utilities for R.*

---

## Description

You can "pop" data off the end of a vector, one element at a time, with `pop()`. You can also "push" new data onto the end of the vector with `push()`. The analogous functions for working at the start of a vector are `shift()` and `unshift()`: `shift()` removes the first element of your vector, and `unshift()` prepends new elements to your vector.

## Usage

```
push(x, values)
```

```
pop(x)
```

```
unshift(x, values)
```

```
shift(x)
```

## Arguments

<code>x</code>	Object, typically a vector or a list.
<code>values</code>	Object to be added to <code>x</code> .

## Details

An important and unusual feature of `push()`, `pop()`, `shift()`, and `unshift()` is that they modify objects "in place"—that is, even when no explicit assignment is done. For example, `pop(x)` will return the last value of `x`, but it will also remove the last value from the `x` object. The examples illustrate this point.

These functions are adapted from Matt Pettis's code at <https://gist.github.com/mpettis/b7bfeff282e3b052684f>.

Previous versions of these functions were adapted from Jeffrey A. Ryan's code at <http://www.lemnica.com/esotericR/Introducing-Closures/>. That code works but is based on the creation of "stack" objects that contain their own environments. One consequence is that changing a copy of a stack object changes the original stack object, and vice versa. Note too that, in Ryan's code, the traditional meanings of `shift()` and `unshift()` are reversed: he uses `shift()` to concatenate objects, `unshift()` to remove a value from an object.

## Value

`pop()` and `shift()` will return a scalar, that is, an object of length 1. `push()` and `unshift()` don't return anything.

## Author(s)

Matt Pettis

John G. Bullock

## See Also

[Thomas Leeper's Gist](#) describes his own implementation of `pop()` and `push()` and includes links to six other implementations. Some of these implementations of `pop()` and `push()` do not have the modify-in-place characteristic of the corresponding Perl functions. This quality is also absent from the constructor function at <https://stackoverflow.com/a/14489296/697473>.

## Examples

```
myStack <- 1:3
push(myStack, 4)
myStack # [1] 1 2 3 4

pop(myStack) # [1] 4
shift(myStack) # [1] 1
myStack # [1] 2 3

unshift(myStack, "hello")
myStack # [1] "hello" "2" "3"

myList <- list(1, 2, 3) # list with three elements
push(myList, 4)
myList # list with 4 elements
shift(myList) # returns 1
myList[[1]] # first element of myList is now 2
```

---

update.latexTable	<i>Update a latexTable object with new arguments.</i>
-------------------	---

---

## Description

Each `latexTable` object stores, as an attribute, the call that produced it. `update.latexTable()` updates the call by replacing arguments or adding new ones. It then calls `latexTable()` to produce a new `latexTable` object.

## Usage

```
## S3 method for class 'latexTable'
update(object, ...)
```

## Arguments

object	A <code>latexTable</code> object
...	Arguments to <code>latexTable()</code> , e.g., <code>colNames</code> , <code>caption</code> .

## Details

`update.latexTable()` is adapted from `stats::update.default()`. It is a method for the generic `update()`.

**Value**

A `latexTable` object.

**Examples**

```
lT1 <- latexTable(matrix(1:16, nrow = 4))
lT2 <- update(lT1, mat = matrix(2:17, nrow = 8), commandName = "intTable")
```

---

%IN%	<i>Value matching</i>
------	-----------------------

---

**Description**

%IN% returns a logical vector indicating whether there is a match for its left operand. It is like %in%, but it has one crucial difference: if there are NA values in the left operand, the corresponding values in the returned vector will also be NA (rather than FALSE, as with %in%.)

**Usage**

```
x %IN% table
```

**Arguments**

x	vector or NULL: the values to be matched.
table	vector or NULL: the values to be matched against.

**Value**

A logical vector of the same length as x. It indicates whether a match was found for each non-NA element of x. NA elements of x are matched by NA elements in the returned vector.

**Note**

The ordinary binary match operator, %in%, can be misleading because it seems more closely related to == than it is. The problem is that == will return NA in some (expected) cases, but %in% will never return NA. Instead, when using %in%, the returned vector will be FALSE for every NA value in the left operand.

Like ==, %IN% will return NA when there are NA values in the left operand. See below for an example.

%IN% will always return TRUE values when %in% would do so, and vice versa. The two operators differ only in the sense that %IN% returns FALSE in some cases where %in% returns NA.

**Author(s)**

John G. Bullock

**See Also**

[%in%](#)

**Examples**

```
tmp <- c(1, 2, 3, NA)
tmp == 1      # TRUE FALSE FALSE NA
tmp %in% 1:2  # TRUE TRUE  FALSE FALSE
tmp %IN% 1:2  # TRUE TRUE  FALSE NA
```

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