

The DATA-FRAME Reference Manual

Data frames for Common Lisp, version 1.1.0

Steve Nunez <steve@symbolics.tech>

This manual was generated automatically by Declt 4.0b2.

Copyright © 2019-2022 Steve Nunez

Permission is granted to make and distribute verbatim copies of this manual provided the copyright notice and this permission notice are preserved on all copies.

Permission is granted to copy and distribute modified versions of this manual under the conditions for verbatim copying, provided also that the section entitled “Copying” is included exactly as in the original.

Permission is granted to copy and distribute translations of this manual into another language, under the above conditions for modified versions, except that this permission notice may be translated as well.

Table of Contents

Copying	1
1 Systems	3
1.1 data-frame	3
2 Files	5
2.1 Lisp	5
2.1.1 data-frame/data-frame.asd	5
2.1.2 data-frame/pkgdcl.lisp	5
2.1.3 data-frame/utils.lisp	5
2.1.4 data-frame/data-frame.lisp	5
2.1.5 data-frame/pprint.lisp	7
2.1.6 data-frame/formatted-output.lisp	8
2.1.7 data-frame/summary.lisp	8
2.1.8 data-frame/defdf.lisp	10
2.1.9 data-frame/conditions.lisp	10
2.1.10 data-frame/properties.lisp	11
2.1.11 data-frame/missing.lisp	11
2.1.12 data-frame/filter.lisp	11
2.1.13 data-frame/plist-aops.lisp	12
2.1.14 data-frame/data.lisp	12
2.1.15 data-frame/rdata.lisp	12
3 Packages	15
3.1 data-frame	15
3.2 rdata	19
4 Definitions	23
4.1 Public Interface	23
4.1.1 Special variables	23
4.1.2 Macros	34
4.1.3 Ordinary functions	34
4.1.4 Generic functions	41
4.1.5 Standalone methods	43
4.1.6 Conditions	44
4.1.7 Structures	45
4.1.8 Classes	48
4.1.9 Types	49
4.2 Internals	49
4.2.1 Special variables	49
4.2.2 Macros	50
4.2.3 Ordinary functions	50
4.2.4 Generic functions	59
4.2.5 Conditions	60
4.2.6 Structures	61

Appendix A	Indexes	63
A.1	Concepts	63
A.2	Functions	64
A.3	Variables	68
A.4	Data types	71

Copying

This program is distributed under the terms of the Microsoft Public License.

1 Systems

The main system appears first, followed by any subsystem dependency.

1.1 data-frame

A data manipulation library for statistical computing

Long Name

Data frames for Common Lisp

Author Steve Nunez <steve@symbolics.tech>

Home Page

<https://lisp-stat.dev/docs/manuals/data-frame>

Source Control

(GIT <https://github.com/Lisp-Stat/data-frame.git>)

Bug Tracker

<https://github.com/Lisp-Stat/data-frame/issues>

License MS-PL

Long Description

A data frame is a common way of storing data for statistical analysis. Under the hood, a data frame is a vector of equal-length vectors. Each element of the vector can be thought of as a column and the length of each element of the vector is the number of rows. As a result, data frames can store different classes of objects in each column (i.e. numeric, character, factor). In essence, the easiest way to think of a data frame is as an Excel worksheet that contains columns of different types of data but are all of equal length rows.

From a design perspective, Lisp-Stat's data frame is conceptually most similar to the 'tibble' from the tidyverse, but using Common Lisp idioms, style and syntax.

Version 1.1.0

Dependencies

- alexandria (system).
- alexandria+ (system).
- anaphora (system).
- array-operations (system).
- num-utils (system).
- select (system).
- statistics (system).
- let-plus (system).
- duologue (system).

Source [data-frame.asd], page 5.

Child Components

- [pkgdcl.lisp], page 5 (file).
- [utils.lisp], page 5 (file).
- [data-frame.lisp], page 5 (file).
- [pprint.lisp], page 7 (file).

- `[formatted-output.lisp]`, page 8 (file).
- `[summary.lisp]`, page 8 (file).
- `[defdf.lisp]`, page 10 (file).
- `[conditions.lisp]`, page 10 (file).
- `[properties.lisp]`, page 11 (file).
- `[missing.lisp]`, page 11 (file).
- `[filter.lisp]`, page 11 (file).
- `[plist-aops.lisp]`, page 12 (file).
- `[data.lisp]`, page 12 (file).
- `[rdata.lisp]`, page 12 (file).

2 Files

Files are sorted by type and then listed depth-first from the systems components trees.

2.1 Lisp

2.1.1 data-frame/data-frame.asd

Source [data-frame.asd], page 5.

Parent Component
[data-frame], page 3 (system).

ASDF Systems
[data-frame], page 3.

2.1.2 data-frame/pkgdcl.lisp

Source [data-frame.asd], page 5.

Parent Component
[data-frame], page 3 (system).

Packages [data-frame], page 15.

2.1.3 data-frame/utils.lisp

Dependency
[pkgdcl.lisp], page 5 (file).

Source [data-frame.asd], page 5.

Parent Component
[data-frame], page 3 (system).

Public Interface

- [column-type], page 35 (function).
- [delete-nth], page 36 (function).
- [delete-nth*], page 34 (macro).

Internals

- [get-type], page 54 (function).
- [types-in-column], page 58 (function).

2.1.4 data-frame/data-frame.lisp

Dependency
[utils.lisp], page 5 (file).

Source [data-frame.asd], page 5.

Parent Component
[data-frame], page 3 (system).

Public Interface

- [*large-data*], page 23 (special variable).
- [add-column!], page 34 (function).
- [add-columns], page 34 (function).

- [add-columns!], page 34 (function).
- [alist-df], page 34 (function).
- [alist-dv], page 34 (function).
- [as-alist], page 43 (method).
- [as-array], page 43 (method).
- [as-array], page 43 (method).
- [axis-dimension], page 43 (method).
- [canonical-representation], page 43 (method).
- [column], page 34 (function).
- [(setf column)], page 35 (function).
- [column-names], page 35 (function).
- [columns], page 35 (function).
- [copy], page 35 (function).
- [count-rows], page 35 (function).
- [data], page 48 (class).
- [data-frame], page 48 (class).
- [data-type], page 49 (type).
- [data-vector], page 49 (class).
- [describe-object], page 43 (method).
- [df], page 36 (function).
- [df-remove-duplicates], page 36 (function).
- [dims], page 43 (method).
- [dims], page 43 (method).
- [do-rows], page 36 (function).
- [dv], page 36 (function).
- [element-type], page 43 (method).
- [initialize-instance], page 43 (method).
- [keys], page 37 (function).
- [make-df], page 38 (function).
- [make-dv], page 38 (function).
- [map-columns], page 38 (function).
- [map-df], page 38 (function).
- [map-rows], page 38 (function).
- [mask-rows], page 38 (function).
- [matrix-df], page 38 (function).
- [name], page 42 (reader method).
- [(setf name)], page 42 (writer method).
- [ncol], page 43 (method).
- [nrow], page 44 (method).
- [plist-df], page 38 (function).
- [plist-dv], page 38 (function).
- [print-object], page 44 (method).
- [print-object], page 44 (method).

- [print-object], page 44 (method).
- [remove-column!], page 39 (function).
- [remove-columns], page 39 (function).
- [rename-column!], page 42 (method).
- [replace-column], page 39 (function).
- [replace-column!], page 39 (function).
- [rows], page 39 (function).
- [select], page 44 (method).
- [select], page 44 (method).
- [select], page 44 (method).

Internals

- [add-key!], page 50 (function).
- [add-keys], page 50 (function).
- [alist-data], page 50 (function).
- [check-column-compatibility], page 59 (generic function).
- [copy-ordered-keys], page 51 (function).
- [define-data-subclass], page 50 (macro).
- [df-env-p], page 52 (function).
- [ensure-arguments-alist], page 52 (function).
- [key-index], page 54 (function).
- [keys-count], page 54 (function).
- [keys-vector], page 54 (function).
- [make-data], page 54 (function).
- [make-ordered-keys], page 55 (function).
- [ordered-keys], page 55 (function).
- [ordered-keys], page 61 (structure).
- [ordered-keys-p], page 55 (function).
- [ordered-keys-table], page 56 (reader).
- [plist-data], page 56 (function).
- [remove-columns!], page 57 (function).
- [remove-key!], page 58 (function).

2.1.5 data-frame/pprint.lisp

Dependency

[data-frame.lisp], page 5 (file).

Source

[data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [head], page 41 (method).
- [print-array], page 39 (function).
- [print-data], page 39 (function).
- [short-string], page 40 (function).

- [tail], page 43 (method).

Internals

- [*max-digits*], page 49 (special variable).
- [*row-numbers-p*], page 50 (special variable).
- [2d-array-to-list], page 50 (function).
- [column-type-format], page 51 (function).
- [default-column-formats], page 60 (method).
- [max-decimal], page 55 (function).
- [max-width], page 55 (function).
- [printer-status], page 56 (function).
- [reverse-df], page 58 (function).

2.1.6 data-frame/formatted-output.lisp

Dependency

[pprint.lisp], page 7 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [df-print], page 36 (function).
- [print-markdown], page 39 (function).

Internals

- [aesthetic-string], page 50 (function).
- [print-table], page 56 (function).
- [weave], page 59 (function).

2.1.7 data-frame/summary.lisp

Dependency

[formatted-output.lisp], page 8 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [*distinct-maximum*], page 23 (special variable).
- [*distinct-threshold*], page 23 (special variable).
- [*quantile-threshold*], page 23 (special variable).
- [*summary-minimum-length*], page 23 (special variable).
- [bit-variable-summary], page 45 (structure).
- [factor-variable-summary], page 46 (structure).
- [generic-variable-summary], page 46 (structure).
- [get-summaries], page 37 (function).
- [print-object], page 44 (method).
- [print-object], page 44 (method).

- [print-object], page 44 (method).
- [print-object], page 44 (method).
- [real-variable-summary], page 46 (structure).
- [summarize-column], page 40 (function).
- [summary], page 40 (function).

Internals

- [bit-variable-summary-count], page 51 (reader).
- [bit-variable-summary-desc], page 51 (function).
- [bit-variable-summary-length], page 51 (function).
- [bit-variable-summary-missing], page 51 (function).
- [bit-variable-summary-name], page 51 (function).
- [bit-variable-summary-p], page 51 (function).
- [column-length], page 59 (generic function).
- [copy-bit-variable-summary], page 51 (function).
- [copy-factor-variable-summary], page 51 (function).
- [copy-generic-variable-summary], page 51 (function).
- [copy-real-variable-summary], page 52 (function).
- [copy-variable-summary%], page 52 (function).
- [distinct], page 52 (function).
- [ensure-not-ratio], page 52 (function).
- [factor-variable-summary-desc], page 52 (function).
- [factor-variable-summary-element-count-alist], page 53 (reader).
- [factor-variable-summary-length], page 53 (function).
- [factor-variable-summary-missing], page 53 (function).
- [factor-variable-summary-name], page 53 (function).
- [factor-variable-summary-p], page 53 (function).
- [generic-variable-summary-desc], page 53 (function).
- [generic-variable-summary-element-count-alist], page 53 (reader).
- [generic-variable-summary-length], page 53 (function).
- [generic-variable-summary-missing], page 53 (function).
- [generic-variable-summary-name], page 53 (function).
- [generic-variable-summary-p], page 53 (function).
- [generic-variable-summary-quantiles], page 54 (reader).
- [make-bit-variable-summary], page 54 (function).
- [make-factor-variable-summary], page 55 (function).
- [make-generic-variable-summary], page 55 (function).
- [make-real-variable-summary], page 55 (function).
- [make-variable-summary%], page 55 (function).
- [monotonicp], page 55 (function).
- [print-count-and-percentage], page 56 (function).
- [real-variable-summary-desc], page 56 (function).
- [real-variable-summary-length], page 56 (function).

- [real-variable-summary-max], page 56 (reader).
- [real-variable-summary-mean], page 57 (reader).
- [real-variable-summary-min], page 57 (reader).
- [real-variable-summary-missing], page 57 (function).
- [real-variable-summary-name], page 57 (function).
- [real-variable-summary-p], page 57 (function).
- [real-variable-summary-q25], page 57 (reader).
- [real-variable-summary-q50], page 57 (reader).
- [real-variable-summary-q75], page 57 (reader).
- [summarize-factor-variable], page 58 (function).
- [summarize-generic-variable], page 58 (function).
- [summarize-real-variable], page 58 (function).
- [variable-summary%], page 61 (structure).
- [variable-summary%-desc], page 58 (reader).
- [variable-summary%-length], page 59 (reader).
- [variable-summary%-missing], page 59 (reader).
- [variable-summary%-name], page 59 (reader).
- [variable-summary%-p], page 59 (function).

2.1.8 data-frame/defdf.lisp

Dependency

[summary.lisp], page 8 (file).

Source

[data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [*ask-on-redefine*], page 23 (special variable).
- [defdf], page 34 (macro).
- [defdf-env], page 36 (function).
- [show-data-frames], page 40 (function).
- [undef], page 40 (function).

Internals

- [*data-frames*], page 49 (special variable).
- [show-symbols], page 58 (function).

2.1.9 data-frame/conditions.lisp

Dependency

[defdf.lisp], page 10 (file).

Source

[data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [data-frame], page 41 (reader method).

- [duplicate-key], page 44 (condition).
- [key-not-found], page 45 (condition).
- [large-data], page 45 (condition).

Internals

- [data-frame-exists], page 60 (condition).
- [data-size], page 60 (reader method).
- [df-exists-p], page 52 (function).
- [invalid-df-name], page 54 (function).
- [missing-data], page 60 (condition).

2.1.10 data-frame/properties.lisp

Dependency

[conditions.lisp], page 10 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [get-property], page 37 (function).
- [heuristic-types], page 37 (function).
- [set-properties], page 40 (function).
- [set-property], page 40 (function).

Internals [show-properties], page 58 (function).

2.1.11 data-frame/missing.lisp

Dependency

[properties.lisp], page 11 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

- [drop-missing], page 41 (method).
- [drop-missing], page 41 (method).
- [ignore-missing], page 37 (function).
- [missingp], page 41 (generic function).
- [replace-missing], page 42 (method).

Internals [drop-na], page 52 (function).

2.1.12 data-frame/filter.lisp

Dependency

[missing.lisp], page 11 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

[filter-rows], page 36 (function).

Internals [key-list], page 54 (function).

2.1.13 data-frame/plist-aops.lisp**Dependency**

[filter.lisp], page 11 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Internals [ensure-plist], page 50 (macro).

2.1.14 data-frame/data.lisp**Dependency**

[plist-aops.lisp], page 12 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Public Interface

[data], page 35 (function).

2.1.15 data-frame/rdata.lisp**Dependency**

[data.lisp], page 12 (file).

Source [data-frame.asd], page 5.

Parent Component

[data-frame], page 3 (system).

Packages [rdata], page 19.

Public Interface

- [*r-default-datasets*], page 23 (special variable).
- [ability.cov], page 24 (special variable).
- [airmiles], page 24 (special variable).
- [airpassengers], page 24 (special variable).
- [airquality], page 24 (special variable).
- [anscombe], page 24 (special variable).
- [attenu], page 24 (special variable).
- [attitude], page 24 (special variable).
- [austres], page 24 (special variable).
- [base-url], page 24 (special variable).
- [bjsales], page 25 (special variable).
- [bod], page 25 (special variable).
- [cars], page 25 (special variable).
- [chickweight], page 25 (special variable).

- [chickwts], page 25 (special variable).
- [co2-1], page 25 (special variable).
- [co2-2], page 25 (special variable).
- [crimtab], page 25 (special variable).
- [discoveries], page 25 (special variable).
- [dnase], page 26 (special variable).
- [esoph], page 26 (special variable).
- [euro], page 26 (special variable).
- [eustockmarkets], page 26 (special variable).
- [faithful], page 26 (special variable).
- [formaldehyde], page 26 (special variable).
- [freeny], page 26 (special variable).
- [haireyecolor], page 26 (special variable).
- [harman23.cor], page 26 (special variable).
- [harman74.cor], page 27 (special variable).
- [index], page 27 (special variable).
- [indometh], page 27 (special variable).
- [infert], page 27 (special variable).
- [insectsprays], page 27 (special variable).
- [iris], page 27 (special variable).
- [iris3], page 27 (special variable).
- [islands], page 27 (special variable).
- [johnsonjohnson], page 27 (special variable).
- [lakehuron], page 27 (special variable).
- [lh], page 28 (special variable).
- [lifecyclesavings], page 28 (special variable).
- [loblolly], page 28 (special variable).
- [longley], page 28 (special variable).
- [lynx], page 28 (special variable).
- [morley], page 28 (special variable).
- [mpg], page 28 (special variable).
- [mtcars], page 28 (special variable).
- [nhtemp], page 28 (special variable).
- [nile], page 29 (special variable).
- [nottem], page 29 (special variable).
- [npk], page 29 (special variable).
- [nycflights13-airlines], page 29 (special variable).
- [nycflights13-airports], page 29 (special variable).
- [nycflights13-flights], page 29 (special variable).
- [nycflights13-planes], page 29 (special variable).
- [nycflights13-weather], page 29 (special variable).
- [occupationalstatus], page 29 (special variable).
- [orange], page 30 (special variable).

- [orchardsprays], page 30 (special variable).
- [plantgrowth], page 30 (special variable).
- [precip], page 30 (special variable).
- [presidents], page 30 (special variable).
- [pressure], page 30 (special variable).
- [puromycin], page 30 (special variable).
- [quakes], page 30 (special variable).
- [randu], page 30 (special variable).
- [rivers], page 31 (special variable).
- [rock], page 31 (special variable).
- [seatbelts], page 31 (special variable).
- [stackloss], page 31 (special variable).
- [sunspot.month], page 31 (special variable).
- [sunspot.year], page 31 (special variable).
- [sunspots], page 31 (special variable).
- [swiss], page 31 (special variable).
- [theoph], page 31 (special variable).
- [titanic], page 32 (special variable).
- [toothgrowth], page 32 (special variable).
- [treering], page 32 (special variable).
- [trees], page 32 (special variable).
- [ucbadmissions], page 32 (special variable).
- [ukdriverdeaths], page 32 (special variable).
- [ukgas], page 32 (special variable).
- [usaccdeaths], page 32 (special variable).
- [usarrests], page 32 (special variable).
- [usjudgeratings], page 33 (special variable).
- [uspersonalexpenditure], page 33 (special variable).
- [uspop], page 33 (special variable).
- [vadeaths], page 33 (special variable).
- [volcano], page 33 (special variable).
- [warpbreaks], page 33 (special variable).
- [women], page 33 (special variable).
- [worldphones], page 33 (special variable).
- [wwwusage], page 33 (special variable).

Internals

- [*r-default-dataframes*], page 49 (special variable).
- [student-sleep], page 50 (special variable).

3 Packages

Packages are listed by definition order.

3.1 data-frame

Source [pkgdcl.lisp], page 5.

Nickname df

Use List

- alexandria.
- alexandria+.
- anaphora.
- common-lisp.
- let-plus.
- select.
- select-dev.

Used By List

dfio.

Public Interface

- [*ask-on-redefine*], page 23 (special variable).
- [*distinct-maximum*], page 23 (special variable).
- [*distinct-threshold*], page 23 (special variable).
- [*large-data*], page 23 (special variable).
- [*quantile-threshold*], page 23 (special variable).
- [*summary-minimum-length*], page 23 (special variable).
- [add-column!], page 34 (function).
- [add-columns], page 34 (function).
- [add-columns!], page 34 (function).
- [alist-df], page 34 (function).
- [alist-dv], page 34 (function).
- [bit-variable-summary], page 45 (structure).
- [column], page 34 (function).
- [(setf column)], page 35 (function).
- [column-names], page 35 (function).
- [column-type], page 35 (function).
- [columns], page 35 (function).
- [copy], page 35 (function).
- [count-rows], page 35 (function).
- [data], page 35 (function).
- [data], page 48 (class).
- [data-frame], page 41 (generic reader).
- [data-frame], page 48 (class).
- [data-type], page 49 (type).

- `[data-vector]`, page 49 (class).
- `[defdf]`, page 34 (macro).
- `[defdf-env]`, page 36 (function).
- `[delete-nth]`, page 36 (function).
- `[delete-nth*]`, page 34 (macro).
- `[df]`, page 36 (function).
- `[df-print]`, page 36 (function).
- `[df-remove-duplicates]`, page 36 (function).
- `[do-rows]`, page 36 (function).
- `[drop-missing]`, page 41 (generic function).
- `[duplicate-key]`, page 44 (condition).
- `[dv]`, page 36 (function).
- `[factor-variable-summary]`, page 46 (structure).
- `[filter-rows]`, page 36 (function).
- `[generic-variable-summary]`, page 46 (structure).
- `[get-property]`, page 37 (function).
- `[get-summaries]`, page 37 (function).
- `[head]`, page 41 (generic function).
- `[heuristic-types]`, page 37 (function).
- `[ignore-missing]`, page 37 (function).
- `[key-not-found]`, page 45 (condition).
- `[keys]`, page 37 (function).
- `[large-data]`, page 45 (condition).
- `[make-df]`, page 38 (function).
- `[make-dv]`, page 38 (function).
- `[map-columns]`, page 38 (function).
- `[map-df]`, page 38 (function).
- `[map-rows]`, page 38 (function).
- `[mask-rows]`, page 38 (function).
- `[matrix-df]`, page 38 (function).
- `[missingp]`, page 41 (generic function).
- `[name]`, page 42 (generic reader).
- `[(setf name)]`, page 42 (generic writer).
- `[plist-df]`, page 38 (function).
- `[plist-dv]`, page 38 (function).
- `[print-array]`, page 39 (function).
- `[print-data]`, page 39 (function).
- `[print-markdown]`, page 39 (function).
- `[real-variable-summary]`, page 46 (structure).
- `[remove-column!]`, page 39 (function).
- `[remove-columns]`, page 39 (function).
- `[rename-column!]`, page 42 (generic function).
- `[replace-column]`, page 39 (function).

- `[replace-column!]`, page 39 (function).
- `[replace-missing]`, page 42 (generic function).
- `[rows]`, page 39 (function).
- `[set-properties]`, page 40 (function).
- `[set-property]`, page 40 (function).
- `[short-string]`, page 40 (function).
- `[show-data-frames]`, page 40 (function).
- `[summarize-column]`, page 40 (function).
- `[summary]`, page 40 (function).
- `[tail]`, page 42 (generic function).
- `[undef]`, page 40 (function).

Internals

- `[*data-frames*]`, page 49 (special variable).
- `[*max-digits*]`, page 49 (special variable).
- `[*row-numbers-p*]`, page 50 (special variable).
- `[2d-array-to-list]`, page 50 (function).
- `[add-key!]`, page 50 (function).
- `[add-keys]`, page 50 (function).
- `[aesthetic-string]`, page 50 (function).
- `[alist-data]`, page 50 (function).
- `[bit-variable-summary-count]`, page 51 (reader).
- `[bit-variable-summary-desc]`, page 51 (function).
- `[bit-variable-summary-length]`, page 51 (function).
- `[bit-variable-summary-missing]`, page 51 (function).
- `[bit-variable-summary-name]`, page 51 (function).
- `[bit-variable-summary-p]`, page 51 (function).
- `[check-column-compatibility]`, page 59 (generic function).
- `[column-length]`, page 59 (generic function).
- `[column-type-format]`, page 51 (function).
- `[copy-bit-variable-summary]`, page 51 (function).
- `[copy-factor-variable-summary]`, page 51 (function).
- `[copy-generic-variable-summary]`, page 51 (function).
- `[copy-ordered-keys]`, page 51 (function).
- `[copy-real-variable-summary]`, page 52 (function).
- `[copy-variable-summary%]`, page 52 (function).
- `[data-frame-exists]`, page 60 (condition).
- `[data-size]`, page 60 (generic reader).
- `[default-column-formats]`, page 60 (generic function).
- `[define-data-subclass]`, page 50 (macro).
- `[df-env-p]`, page 52 (function).
- `[df-exists-p]`, page 52 (function).
- `[distinct]`, page 52 (function).

- [drop-na], page 52 (function).
- [ensure-arguments-alist], page 52 (function).
- [ensure-not-ratio], page 52 (function).
- [ensure-plist], page 50 (macro).
- [factor-variable-summary-desc], page 52 (function).
- [factor-variable-summary-element-count-alist], page 53 (reader).
- [factor-variable-summary-length], page 53 (function).
- [factor-variable-summary-missing], page 53 (function).
- [factor-variable-summary-name], page 53 (function).
- [factor-variable-summary-p], page 53 (function).
- [generic-variable-summary-desc], page 53 (function).
- [generic-variable-summary-element-count-alist], page 53 (reader).
- [generic-variable-summary-length], page 53 (function).
- [generic-variable-summary-missing], page 53 (function).
- [generic-variable-summary-name], page 53 (function).
- [generic-variable-summary-p], page 53 (function).
- [generic-variable-summary-quantiles], page 54 (reader).
- [get-type], page 54 (function).
- [invalid-df-name], page 54 (function).
- [key-index], page 54 (function).
- [key-list], page 54 (function).
- [keys-count], page 54 (function).
- [keys-vector], page 54 (function).
- [make-bit-variable-summary], page 54 (function).
- [make-data], page 54 (function).
- [make-factor-variable-summary], page 55 (function).
- [make-generic-variable-summary], page 55 (function).
- [make-ordered-keys], page 55 (function).
- [make-real-variable-summary], page 55 (function).
- [make-variable-summary%], page 55 (function).
- [max-decimal], page 55 (function).
- [max-width], page 55 (function).
- [missing-data], page 60 (condition).
- [monotonicp], page 55 (function).
- [ordered-keys], page 55 (function).
- [ordered-keys], page 61 (structure).
- [ordered-keys-p], page 55 (function).
- [ordered-keys-table], page 56 (reader).
- [plist-data], page 56 (function).
- [print-count-and-percentage], page 56 (function).
- [print-table], page 56 (function).
- [printer-status], page 56 (function).
- [real-variable-summary-desc], page 56 (function).

- [real-variable-summary-length], page 56 (function).
- [real-variable-summary-max], page 56 (reader).
- [real-variable-summary-mean], page 57 (reader).
- [real-variable-summary-min], page 57 (reader).
- [real-variable-summary-missing], page 57 (function).
- [real-variable-summary-name], page 57 (function).
- [real-variable-summary-p], page 57 (function).
- [real-variable-summary-q25], page 57 (reader).
- [real-variable-summary-q50], page 57 (reader).
- [real-variable-summary-q75], page 57 (reader).
- [remove-columns!], page 57 (function).
- [remove-key!], page 58 (function).
- [reverse-df], page 58 (function).
- [show-properties], page 58 (function).
- [show-symbols], page 58 (function).
- [summarize-factor-variable], page 58 (function).
- [summarize-generic-variable], page 58 (function).
- [summarize-real-variable], page 58 (function).
- [types-in-column], page 58 (function).
- [variable-summary%], page 61 (structure).
- [variable-summary%-desc], page 58 (reader).
- [variable-summary%-length], page 59 (reader).
- [variable-summary%-missing], page 59 (reader).
- [variable-summary%-name], page 59 (reader).
- [variable-summary%-p], page 59 (function).
- [weave], page 59 (function).

3.2 rdata

Source [rdata.lisp], page 12.

Use List common-lisp.

Public Interface

- [*r-default-datasets*], page 23 (special variable).
- [ability.cov], page 24 (special variable).
- [airmiles], page 24 (special variable).
- [airpassengers], page 24 (special variable).
- [airquality], page 24 (special variable).
- [anscombe], page 24 (special variable).
- [attenu], page 24 (special variable).
- [attitude], page 24 (special variable).
- [austres], page 24 (special variable).
- [base-url], page 24 (special variable).
- [bjsales], page 25 (special variable).

- [bod], page 25 (special variable).
- [cars], page 25 (special variable).
- [chickweight], page 25 (special variable).
- [chickwts], page 25 (special variable).
- [co2-1], page 25 (special variable).
- [co2-2], page 25 (special variable).
- [crimtab], page 25 (special variable).
- [discoveries], page 25 (special variable).
- [dnase], page 26 (special variable).
- [esoph], page 26 (special variable).
- [euro], page 26 (special variable).
- [eustockmarkets], page 26 (special variable).
- [faithful], page 26 (special variable).
- [formaldehyde], page 26 (special variable).
- [freeny], page 26 (special variable).
- [haireyecolor], page 26 (special variable).
- [harman23.cor], page 26 (special variable).
- [harman74.cor], page 27 (special variable).
- [index], page 27 (special variable).
- [indometh], page 27 (special variable).
- [infert], page 27 (special variable).
- [insectsprays], page 27 (special variable).
- [iris], page 27 (special variable).
- [iris3], page 27 (special variable).
- [islands], page 27 (special variable).
- [johnsonjohnson], page 27 (special variable).
- [lakehuron], page 27 (special variable).
- [lh], page 28 (special variable).
- [lifecyclesavings], page 28 (special variable).
- [loblolly], page 28 (special variable).
- [longley], page 28 (special variable).
- [lynx], page 28 (special variable).
- [morley], page 28 (special variable).
- [mpg], page 28 (special variable).
- [mtcars], page 28 (special variable).
- [nhtemp], page 28 (special variable).
- [nile], page 29 (special variable).
- [nottem], page 29 (special variable).
- [npk], page 29 (special variable).
- [nycflights13-airlines], page 29 (special variable).
- [nycflights13-airports], page 29 (special variable).
- [nycflights13-flights], page 29 (special variable).
- [nycflights13-planes], page 29 (special variable).

- `[nycflights13-weather]`, page 29 (special variable).
- `[occupationalstatus]`, page 29 (special variable).
- `[orange]`, page 30 (special variable).
- `[orchardsprays]`, page 30 (special variable).
- `[plantgrowth]`, page 30 (special variable).
- `[precip]`, page 30 (special variable).
- `[presidents]`, page 30 (special variable).
- `[pressure]`, page 30 (special variable).
- `[puromycin]`, page 30 (special variable).
- `[quakes]`, page 30 (special variable).
- `[randu]`, page 30 (special variable).
- `[rivers]`, page 31 (special variable).
- `[rock]`, page 31 (special variable).
- `[seatbelts]`, page 31 (special variable).
- `[stackloss]`, page 31 (special variable).
- `[sunspot.month]`, page 31 (special variable).
- `[sunspot.year]`, page 31 (special variable).
- `[sunspots]`, page 31 (special variable).
- `[swiss]`, page 31 (special variable).
- `[theoph]`, page 31 (special variable).
- `[titanic]`, page 32 (special variable).
- `[toothgrowth]`, page 32 (special variable).
- `[treering]`, page 32 (special variable).
- `[trees]`, page 32 (special variable).
- `[ucbadmissions]`, page 32 (special variable).
- `[ukdriverdeaths]`, page 32 (special variable).
- `[ukgas]`, page 32 (special variable).
- `[usaccdeaths]`, page 32 (special variable).
- `[usarrests]`, page 32 (special variable).
- `[usjudgeratings]`, page 33 (special variable).
- `[uspersonalexpenditure]`, page 33 (special variable).
- `[uspop]`, page 33 (special variable).
- `[vadeaths]`, page 33 (special variable).
- `[volcano]`, page 33 (special variable).
- `[warpbreaks]`, page 33 (special variable).
- `[women]`, page 33 (special variable).
- `[worldphones]`, page 33 (special variable).
- `[wwwusage]`, page 33 (special variable).

Internals

- `[*r-default-dataframes*]`, page 49 (special variable).
- `[student-sleep]`, page 50 (special variable).

4 Definitions

Definitions are sorted by export status, category, package, and then by lexicographic order.

4.1 Public Interface

4.1.1 Special variables

ask-on-redefine [Special Variable]

If non-nil, the system will ask the user for confirmation before redefining a data frame

Package [data-frame], page 15.

Source [defdf.lisp], page 10.

distinct-maximum [Special Variable]

If a string/factor variable has > *distinct-maximum* values, exclude it

Package [data-frame], page 15.

Source [summary.lisp], page 8.

distinct-threshold [Special Variable]

If an integer variable has <= discrete values, consider it a factor

Package [data-frame], page 15.

Source [summary.lisp], page 8.

large-data [Special Variable]

An indication that the data set is large for a particular use case.

This should be bound by a user to the maximum number of data points they consider to be 'normal'. The function can then signal a large-data warning if it is exceeded.

E.g. (let ((df:*large-data* 50000))

(handler-bind ((large-data ...

(some-data-operation ; this will signal if the data is too large

(restart-bind ...

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

quantile-threshold [Special Variable]

If the number of unique reals exceeds this threshold, they will be summarized with quantiles, otherwise print frequency table

Package [data-frame], page 15.

Source [summary.lisp], page 8.

r-default-datasets [Special Variable]

All data sets included by default in R

Package [rdata], page 19.

Source [rdata.lisp], page 12.

summary-minimum-length [Special Variable]

Columns are only summarised when longer than this, otherwise they are returned as is.

Package [data-frame], page 15.

Source [summary.lisp], page 8.

ability.cov	[Special Variable]
Ability and Intelligence Tests	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
airmiles	[Special Variable]
Passenger Miles on Commercial US Airlines, 1937-1960	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
airpassengers	[Special Variable]
Monthly Airline Passenger Numbers 1949-1960	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
airquality	[Special Variable]
New York Air Quality Measurements	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
anscombe	[Special Variable]
Anscombe's Quartet of 'Identical' Simple Linear Regressions	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
attenu	[Special Variable]
The Joyner-Boore Attenuation Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
attitude	[Special Variable]
The Chatterjee-Price Attitude Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
austres	[Special Variable]
Quarterly Time Series of the Number of Australian Residents	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
base-url	[Special Variable]
Base URL for datasets included in R	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

bjsales	[Special Variable]
Sales Data with Leading Indicator	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
bod	[Special Variable]
Biochemical Oxygen Demand	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
cars	[Special Variable]
Speed and Stopping Distances of Cars	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
chickweight	[Special Variable]
Weight versus age of chicks on different diets	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
chickwts	[Special Variable]
Chicken Weights by Feed Type	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
co2-1	[Special Variable]
Carbon Dioxide Uptake in Grass Plants	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
co2-2	[Special Variable]
Mauna Loa Atmospheric CO2 Concentration	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
crimtab	[Special Variable]
Student's 3000 Criminals Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
discoveries	[Special Variable]
Yearly Numbers of Important Discoveries	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

dnase	[Special Variable]
Elisa assay of DNase	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
esoph	[Special Variable]
Smoking, Alcohol and (O)esophageal Cancer	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
euro	[Special Variable]
Conversion Rates of Euro Currencies	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
eustockmarkets	[Special Variable]
Daily Closing Prices of Major European Stock Indices, 1991-1998	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
faithful	[Special Variable]
Old Faithful Geyser Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
formaldehyde	[Special Variable]
Determination of Formaldehyde	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
freeny	[Special Variable]
Freeny's Revenue Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
haireyecolor	[Special Variable]
Hair and Eye Color of Statistics Students	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
harman23.cor	[Special Variable]
Harman Example 2.3	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

harman74.cor Harman Example 7.4	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
index	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
indometh Pharmacokinetics of Indomethacin	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
infert Infertility after Spontaneous and Induced Abortion	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
insectsprays Effectiveness of Insect Sprays	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
iris Edgar Anderson's Iris Data	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
iris3 Edgar Anderson's Iris Data	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
islands Areas of the World's Major Landmasses	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
johnsonjohnson Quarterly Earnings per Johnson & Johnson Share	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
lakehuron Level of Lake Huron 1875-1972	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	

lh	[Special Variable]
Luteinizing Hormone in Blood Samples	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
lifecyclesavings	[Special Variable]
Intercountry Life-Cycle Savings Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
loblolly	[Special Variable]
Growth of Loblolly pine trees	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
longley	[Special Variable]
Longley's Economic Regression Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
lynx	[Special Variable]
Annual Canadian Lynx trappings 1821-1934	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
morley	[Special Variable]
Michelson Speed of Light Data	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
mpg	[Special Variable]
Fuel economy data from 1999 to 2008 for 38 popular models of cars	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
mtcars	[Special Variable]
Motor Trend Car Road Tests	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nhtemp	[Special Variable]
Average Yearly Temperatures in New Haven	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

nile	[Special Variable]
Flow of the River Nile	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nottem	[Special Variable]
Average Monthly Temperatures at Nottingham, 1920-1939	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
npk	[Special Variable]
Classical N, P, K Factorial Experiment	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nycflights13-airlines	[Special Variable]
Airline name lookup table by carrier code	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nycflights13-airports	[Special Variable]
Airport metadata	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nycflights13-flights	[Special Variable]
On-time data for all flights that departed NYC (i.e. JFK, LGA or EWR) in 2013	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nycflights13-planes	[Special Variable]
Metadata for all airplane tail numbers found in the FAA aircraft registry	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
nycflights13-weather	[Special Variable]
Hourly meteorological data for LGA, JFK and EWR in 2013	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
occupationalstatus	[Special Variable]
Occupational Status of Fathers and their Sons	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

orange	[Special Variable]
Growth of Orange Trees	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
orchardsprays	[Special Variable]
Potency of Orchard Sprays	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
plantgrowth	[Special Variable]
Results from an Experiment on Plant Growth	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
precip	[Special Variable]
Annual Precipitation in US Cities	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
presidents	[Special Variable]
Quarterly Approval Ratings of US Presidents	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
pressure	[Special Variable]
Vapor Pressure of Mercury as a Function of Temperature	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
puromycin	[Special Variable]
Reaction Velocity of an Enzymatic Reaction	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
quakes	[Special Variable]
Locations of Earthquakes off Fiji	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
randu	[Special Variable]
Random Numbers from Congruential Generator RANDU	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

rivers	[Special Variable]
Lengths of Major North American Rivers	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
rock	[Special Variable]
Measurements on Petroleum Rock Samples	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
seatbelts	[Special Variable]
Road Casualties in Great Britain 1969-84	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
stackloss	[Special Variable]
Brownlee's Stack Loss Plant Data	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
sunspot.month	[Special Variable]
Monthly Sunspot Data, from 1749 to Present	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
sunspot.year	[Special Variable]
Yearly Sunspot Data, 1700-1988	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
sunspots	[Special Variable]
Monthly Sunspot Numbers, 1749-1983	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
swiss	[Special Variable]
Swiss Fertility and Socioeconomic Indicators (1888) Data	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
theoph	[Special Variable]
Pharmacokinetics of Theophylline	
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	

titanic	[Special Variable]
Survival of passengers on the Titanic	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
toothgrowth	[Special Variable]
The Effect of Vitamin C on Tooth Growth in Guinea Pigs	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
treering	[Special Variable]
Yearly Treering Data, -6000-1979	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
trees	[Special Variable]
Diameter, Height and Volume for Black Cherry Trees	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
ucbadmissions	[Special Variable]
Student Admissions at UC Berkeley	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
ukdriverdeaths	[Special Variable]
Road Casualties in Great Britain 1969-84	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
ukgas	[Special Variable]
UK Quarterly Gas Consumption	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
usaccdeaths	[Special Variable]
Accidental Deaths in the US 1973-1978	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.
usarrests	[Special Variable]
Violent Crime Rates by US State	
Package	[rdata], page 19.
Source	[rdata.lisp], page 12.

usjudgeratings Lawyers' Ratings of State Judges in the US Superior Court	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
uspersonalexpenditure Personal Expenditure Data	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
uspop Populations Recorded by the US Census	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
vadeaths Death Rates in Virginia (1940)	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
volcano Topographic Information on Auckland's Maunga Whau Volcano	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
warpbreaks The Number of Breaks in Yarn during Weaving	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
women Average Heights and Weights for American Women	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
worldphones The World's Telephones	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	
wwwusage Internet Usage per Minute	[Special Variable]
Package [rdata], page 19.	
Source [rdata.lisp], page 12.	

4.1.2 Macros

defdf (*name data &optional documentation*) [Macro]

Define a data-frame and package by the same name.

Also defines symbol-macros for variable access, e.g. `mtcars:mpg`

Package [data-frame], page 15.

Source [defdf.lisp], page 10.

delete-nth* (*place n*) [Macro]

Destructively modifies N, a SEQUENCE by removing the Nth item. Example:

```
LS-USER> (defparameter *v* #(a b c d))
```

```
*v*
```

```
LS-USER> (delete-nth* *v* 1)
```

```
#(A C D)
```

```
LS-USER> *v*
```

```
#(A C D)
```

Package [data-frame], page 15.

Source [utils.lisp], page 5.

4.1.3 Ordinary functions

add-column! (*data key column &optional update-env*) [Function]

Modify DATA (a data-frame or data-vector) by adding COLUMN with KEY. Return DATA.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

add-columns (*data &rest keys-and-columns*) [Function]

Return a new data-frame or data-vector with keys and columns added. Does not modify DATA.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

add-columns! (*data &rest keys-and-columns*) [Function]

Modify DATA (a data-frame or data-vector) by adding columns with keys. If a data-frame environment exists, add columns to it as well.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

alist-df (*alist*) [Function]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

alist-dv (*alist*) [Function]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

column (*data key*) [Function]

Return column corresponding to key.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

(setf column) (data key) [Function]
 Set column corresponding to key.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

column-names (df) [Function]
 Return a list of column names in DF, as strings

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

column-type (col) [Function]
 Return the most specific type found in COL

Package [data-frame], page 15.

Source [utils.lisp], page 5.

columns (data &optional slice) [Function]
 Return the columns of DATA as a vector, or a selection if given (keys are resolved).

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

copy (data &key key) [Function]
 Copy data frame or vector. Keys are copied (and thus can be modified), columns or elements are copied using KEY, making the default give a shallow copy.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

count-rows (data-frame keys predicate) [Function]
 Count the number of rows for which PREDICATE called on the columns corresponding to KEYS returns non-NIL.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

data (d &key system directory type) [Function]
 Load a data frame from a CSV or LISP data source located on the local filesystem named by D. Intended for example data sets for Lisp-Stat system. Parameters may be either a KEYWORD or STRING. JSON files require application specific loaders, so not handled here. Use (read-vega ...) for example.

Description

Each package using lisp-stat should define its own logical host, and a directory called DATA. Once done, you can load the example data sets like so:

```
LS-USER> (data my-example :system :glimpse)
```

If the system is named GLIMPSE. To load a data set from R, assuming you have configured a logical host, RDATA:

```
LS-USER> (data :antigua :system :rdata :directory :daag :type :csv)
```

Package [data-frame], page 15.

Source [data.lisp], page 12.

defdf-env (*data-frame old-keys*) [Function]

Create a package with the same name as DATA-FRAME. Within it, create a symbol-macro for each column that will return the columns value. Can also be used to remove and update the environment as the DATA-FRAME changes in destructive operations

Package [data-frame], page 15.

Source [defdf.lisp], page 10.

delete-nth (*sequence n*) [Function]

Return SEQUENCE with the Nth item removed.

Note: DELETE-IF makes no guarantee of being destructive, so you cannot rely on this side-effect. You must SETF the original sequence to the values returned from this function, or use the modify-macro DELETE-NTH*

Package [data-frame], page 15.

Source [utils.lisp], page 5.

df (&rest *plist-or-alist*) [Function]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

df-print (*df*) [Function]

Print DF to *standard-output* in table format

Package [data-frame], page 15.

Source [formatted-output.lisp], page 8.

df-remove-duplicates (*data*) [Function]

Return a modified copy of DATA from which any element (row, if a DATA-FRAME) that matches another element has been removed

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

do-rows (*data-frame keys function*) [Function]

Traverse rows from first to last, calling FUNCTION on the columns corresponding to KEYS. Return no values.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

dv (&rest *plist-or-alist*) [Function]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

filter-rows (*data body*) [Function]

Filter DATA by a predicate given in BODY

Example

```
(data :mtcars) ; load a data set
(head mtcars) ; view first 6 rows
```



```
;; MODEL MPG CYL DISP HP DRAT WT QSEC VS AM GEAR CARB ;; 0 Mazda RX4
21.0 6 160 110 3.90 2.620 16.46 0 1 4 4 ;; 1 Mazda RX4 Wag 21.0 6 160 110 3.90 2.875 17.02
0 1 4 4 ;; 2 Datsun 710 22.8 4 108 93 3.85 2.320 18.61 1 1 4 1 ;; 3 Hornet 4 Drive 21.4 6 258
110 3.08 3.215 19.44 1 0 3 1 ;; 4 Hornet Sportabout 18.7 8 360 175 3.15 3.440 17.02 0 0 3 2 ;;
5 Valiant 18.1 6 225 105 2.76 3.460 20.22 1 0 3 1
```

```
(filter-rows mtcars '(< mpg 17))
#<DATA-FRAME (11 observations of 12 variables)>
```

```
(head *) ; view first 6 rows of filtered data frame
```

```
;; MODEL MPG CYL DISP HP DRAT WT QSEC VS AM GEAR CARB ;; 0 Duster 360
14.3 8 360.0 245 3.21 3.570 15.84 0 0 3 4 ;; 1 Merc 450SE 16.4 8 275.8 180 3.07 4.070 17.40
0 0 3 3 ;; 2 Merc 450SLC 15.2 8 275.8 180 3.07 3.780 18.00 0 0 3 3 ;; 3 Cadillac Fleetwood
10.4 8 472.0 205 2.93 5.250 17.98 0 0 3 4 ;; 4 Lincoln Continental 10.4 8 460.0 215 3.00 5.424
17.82 0 0 3 4 ;; 5 Chrysler Imperial 14.7 8 440.0 230 3.23 5.345 17.42 0 0 3 4
```

Package [data-frame], page 15.

Source [filter.lisp], page 11.

get-property (*variable property*) [Function]
Return the PROPERTY of data VARIABLE

Package [data-frame], page 15.

Source [properties.lisp], page 11.

get-summaries (*df*) [Function]
Return a list of summaries of the variables in DF

Package [data-frame], page 15.

Source [summary.lisp], page 8.

heuristicate-types (*df*) [Function]
Coerce each element of the column vectors to the most specific type in the column

Often when reading in a data set, the types will be inconsistent in a variable. For example one observation might be 5.1, and another 5. Whilst mathematically equivalent, we want our variable vectors to have identical types. The COLUMN-TYPE function returns the most specific numeric type in the column, then coerces all the vector elements to this type

Package [data-frame], page 15.

Source [properties.lisp], page 11.

ignore-missing (*function &key warn-user provide-restart*) [Function]

Wrap FUNCTION in a closure that removes missing values and applies FUNCTION in case any of the arguments are :MISSING, :NA or NIL to arguments. Intended for functions accepting vectors.

Package [data-frame], page 15.

Source [missing.lisp], page 11.

keys (*data*) [Function]
Return a vector of keys.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

- make-df** (*keys columns*) [Function]
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- make-dv** (*keys columns*) [Function]
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- map-columns** (*data function &optional result-class*) [Function]
 Map columns of DATA-FRAME or DATA-VECTOR using FUNCTION. The result is a new DATA-FRAME with the same keys.
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- map-df** (*data-frame keys function result-keys*) [Function]
 Map DATA-FRAME to another one by rows. Function is called on the columns corresponding to KEYS, and should return a sequence with the same length as RESULT-KEYS, which give the keys of the resulting data frame. RESULT-KETS should be either symbols, or of the format (symbol &optional (element-type t)).
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- map-rows** (*data-frame keys function &key element-type*) [Function]
 Map rows using FUNCTION, on the columns corresponding to KEYS. Return the result with the given ELEMENT-TYPE.
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- mask-rows** (*data-frame keys predicate*) [Function]
 Return a bit-vector containing the result of calling PREDICATE on rows of the columns corresponding to KEYS (0 for NIL, 1 otherwise).
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- matrix-df** (*keys matrix*) [Function]
 Convert a matrix to a data-frame with the given keys.
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- plist-df** (*plist*) [Function]
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.
- plist-dv** (*plist*) [Function]
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.

- print-array** (*arr* **&optional** *stream row-numbers-p*) [Function]
 Print an array to STREAM, defaulting to *standard-output*, in a tabular format. If ROW-NUMBERS-P, print row numbers.
Package [data-frame], page 15.
Source [pprint.lisp], page 7.
- print-data** (*data-frame* **&optional** *stream row-numbers-p max-digits*) [Function]
 Print DATA-FRAME to STREAM using the pretty printer
Package [data-frame], page 15.
Source [pprint.lisp], page 7.
- print-markdown** (*df* **&key** *stream row-numbers*) [Function]
 Print data frame DF, in markdown format, to STREAM
 If ROW-NUMBERS is true, also print row numbers as the first column
Package [data-frame], page 15.
Source [formatted-output.lisp], page 8.
- remove-column!** (*data key*) [Function]
 Modify DATA (a data-frame or data-vector) by removing COLUMN with KEY. Return DATA.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- remove-columns** (*data keys*) [Function]
 Return a new data-frame or data-vector with keys and columns removed. Does not modify DATA. ARGS: DATA data frame
 KEYS list of keys (variables) to be removed
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- replace-column** (*data key function-or-column* **&key** *element-type*) [Function]
 Create a new data frame with new column KEY from data-frame DATA by replacing it either with the given column, or applying the function to the current values (ELEMENT-TYPE is used.)
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- replace-column!** (*data key function-or-column* **&key** *element-type*) [Function]
 Modify column KEY of data-frame DATA by replacing it either with the given column, or applying the function to the current values (ELEMENT-TYPE is used.)
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- rows** (*data*) [Function]
 Return the rows of DATA as a vector
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.

set-properties (*df property prop-values*) [Function]

Set the PROPERTY of each variable in DF to a value. The value is specified in the plist PROP-VALUES. Example:

To give the variables in the mtcars dataset a unit, use:

```
(set-properties mtcars :unit '(:mpg m/g
:cyl :NA
:disp in3
:hp hp
:drat :NA
:wt lb
:qsec s
:vs :NA
:am :NA
:gear :NA
:carb :NA))
```

Package [data-frame], page 15.

Source [properties.lisp], page 11.

set-property (*symbol value property*) [Function]

Set the PROPERTY of SYMBOL to VALUE

Package [data-frame], page 15.

Source [properties.lisp], page 11.

short-string (*str*) [Function]

Return up to the first newline

This is useful when docstrings are multi-line. By convention, the first line is the title.

Package [data-frame], page 15.

Source [pprint.lisp], page 7.

show-data-frames (*&key head stream*) [Function]

Print all data frames in the current environment in reverse order of creation, i.e. most recently created first. If HEAD is not NIL, print the first six rows, similar to the (head) function

Package [data-frame], page 15.

Source [defdf.lisp], page 10.

summarize-column (*column &optional name*) [Function]

Return a summary struct for COLUMN

Package [data-frame], page 15.

Source [summary.lisp], page 8.

summary (*df &optional stream*) [Function]

Print a summary of DF to STREAM, using heuristics for better formatting

Package [data-frame], page 15.

Source [summary.lisp], page 8.

undef (*&rest params*) [Function]

Remove one or more data frames from the environment

PARAMS: a list of DATA-FRAMES

Essentially reverses what DEFDF does. Returns the data frames that were removed. Don't use this if you have a data frame bound via DEFPARAMETER. Examples:
(undef mtcars vlcars)

Package [data-frame], page 15.

Source [defdf.lisp], page 10.

4.1.4 Generic functions

data-frame (*condition*) [Generic Reader]

Package [data-frame], page 15.

Methods

data-frame ((*condition* [data-frame-exists],
page 60)) [Reader Method]

Source [conditions.lisp], page 10.

Target Slot
[data-frame], page 60.

drop-missing (*df* &optional *predicate*) [Generic Function]

Package [data-frame], page 15.

Methods

drop-missing ((*var vector*) &optional *predicate*) [Method]

Remove all values from VAR that are missing according to PREDICATE.

Returns values:

1. the vector with missing values removed
2. the number of elements removed

Source [missing.lisp], page 11.

drop-missing ((*df* [data-frame], page 48) &optional
predicate) [Method]

Remove all rows from DF that are missing values according to PREDICATE

Source [missing.lisp], page 11.

head (*df* &optional *n*) [Generic Function]

Package [data-frame], page 15.

Methods

head ((*df* [data-frame], page 48) &optional *n*) [Method]

Return the first N rows of DF; N defaults to 6

Source [pprint.lisp], page 7.

missingp (*data*) [Generic Function]

Return a vector indicating the position of any missing value indicators. They currently are :na and :missing

Package [data-frame], page 15.

Source [missing.lisp], page 11.

Methods

<code>missingp</code>	<code>(data)</code>	[Method]
<code>missingp</code>	<code>((data (eq1 :na)))</code>	[Method]
<code>missingp</code>	<code>((data (eq1 :missing)))</code>	[Method]
<code>missingp</code>	<code>((data string))</code>	[Method]
<code>missingp</code>	<code>((data sequence))</code>	[Method]
<code>missingp</code>	<code>((data array))</code>	[Method]
<code>missingp</code>	<code>((data [data-frame], page 48))</code>	[Method]
<code>name</code>	<code>(object)</code>	[Generic Reader]
<code>(setf name)</code>	<code>(object)</code>	[Generic Writer]
Package	[data-frame], page 15.	
Methods		
<code>name</code>	<code>((data [data], page 48))</code>	[Reader Method]
<code>(setf name)</code>	<code>((data [data], page 48))</code>	[Writer Method]
	The name of the data frame. MUST be the same as the symbol whose value cell points to this data frame. This slot essentially allows us to go 'backwards' and get the symbol that names the data frame.	
Source	[data-frame.lisp], page 5.	
Target Slot	[name], page 48.	
<code>rename-column!</code>	<code>(data new old)</code>	[Generic Function]
Package	[data-frame], page 15.	
Methods		
<code>rename-column!</code>	<code>(data new old)</code>	[Method]
	Substitute NEW, a SYMBOL, for OLD in DF	
	Useful when reading data files that have an empty or generated column name.	
	Example: <code>(rename-column! cars 'name :)</code> will replace an empty symbol with 'name	
Source	[data-frame.lisp], page 5.	
<code>replace-missing</code>	<code>(df map-alist)</code>	[Generic Function]
Package	[data-frame], page 15.	
Methods		
<code>replace-missing</code>	<code>((df [data-frame], page 48) map-alist)</code>	[Method]
	Replace missing values with the values specified	
	The alist consists of a column name in the CAR and the replacement value in the CDR Example: <code>(replace-missing mtcarsm '((mpg . foo)))</code>	
Source	[missing.lisp], page 11.	
<code>tail</code>	<code>(df &optional n)</code>	[Generic Function]
Package	[data-frame], page 15.	
Methods		

`tail ((df [data-frame], page 48) &optional n)` [Method]
 Return the last N rows of DF; N defaults to 6
Source [pprint.lisp], page 7.

4.1.5 Standalone methods

`as-alist ((data [data], page 48))` [Method]
 Key-column pairs as an alist.

Package num-utils.utilities.

Source [data-frame.lisp], page 5.

`as-array ((data-vector [data-vector], page 49))` [Method]

Package array-operations/generic.

Source [data-frame.lisp], page 5.

`as-array ((data-frame [data-frame], page 48))` [Method]

Package array-operations/generic.

Source [data-frame.lisp], page 5.

`axis-dimension ((axis [ordered-keys], page 61))` [Method]

Package select-dev.

Source [data-frame.lisp], page 5.

`canonical-representation ((axis [ordered-keys], page 61) (slice symbol))` [Method]

Package select-dev.

Source [data-frame.lisp], page 5.

`describe-object ((df [data-frame], page 48) stream)` [Method]

Source [data-frame.lisp], page 5.

`dims ((data-vector [data-vector], page 49))` [Method]

Package array-operations/generic.

Source [data-frame.lisp], page 5.

`dims ((data-frame [data-frame], page 48))` [Method]

Package array-operations/generic.

Source [data-frame.lisp], page 5.

`element-type ((data [data], page 48))` [Method]

Package array-operations/generic.

Source [data-frame.lisp], page 5.

`initialize-instance :after ((data-frame [data-frame], page 48) &rest initargs)` [Method]

Source [data-frame.lisp], page 5.

`ncol ((data-frame [data-frame], page 48))` [Method]

Package array-operations/generic.

Source [data-frame.lisp], page 5.

<code>nrow</code> ((<i>data-frame</i> [<i>data-frame</i>], page 48))	[Method]
Package array-operations/generic.	
Source [data-frame.lisp], page 5.	
<code>print-object</code> ((<i>data-vector</i> [<i>data-vector</i>], page 49) <i>stream</i>)	[Method]
Source [data-frame.lisp], page 5.	
<code>print-object</code> ((<i>df</i> [<i>data-frame</i>], page 48) <i>stream</i>)	[Method]
Print DATA-FRAME dimensions and type	
After defining this method it is permanently associated with data-frame objects	
Source [data-frame.lisp], page 5.	
<code>print-object</code> ((<i>object</i> [<i>generic-variable-summary</i>], page 46) <i>stream</i>)	[Method]
Source [summary.lisp], page 8.	
<code>print-object</code> ((<i>object</i> [<i>factor-variable-summary</i>], page 46) <i>stream</i>)	[Method]
Source [summary.lisp], page 8.	
<code>print-object</code> ((<i>object</i> [<i>bit-variable-summary</i>], page 45) <i>stream</i>)	[Method]
Source [summary.lisp], page 8.	
<code>print-object</code> ((<i>object</i> [<i>real-variable-summary</i>], page 46) <i>stream</i>)	[Method]
Source [summary.lisp], page 8.	
<code>print-object</code> ((<i>ordered-keys</i> [<i>ordered-keys</i>], page 61) <i>stream</i>)	[Method]
Source [data-frame.lisp], page 5.	
<code>select</code> ((<i>data-vector</i> [<i>data-vector</i>], page 49) &rest <i>slices</i>)	[Method]
Package select.	
Source [data-frame.lisp], page 5.	
<code>select</code> ((<i>data-frame</i> [<i>data-frame</i>], page 48) &rest <i>slices</i>)	[Method]
Package select.	
Source [data-frame.lisp], page 5.	
<code>select</code> ((<i>ordered-keys</i> [<i>ordered-keys</i>], page 61) &rest <i>selections</i>)	[Method]
Package select.	
Source [data-frame.lisp], page 5.	

4.1.6 Conditions

<code>duplicate-key</code>	[Condition]
An operation attempted to use a key that already exists in ORDERED-KEYS	
Package [data-frame], page 15.	
Source [conditions.lisp], page 10.	
Direct superclasses	
error.	
Direct slots	
key	[Slot]
Initargs :key	

key-not-found [Condition]

An operation was attempted on a non-existent key.

Package [data-frame], page 15.

Source [conditions.lisp], page 10.

Direct superclasses

error.

Direct slots

key [Slot]

Initargs :key

keys [Slot]

Initargs :keys

large-data [Condition]

An operation was requested on a data set large enough to potentially cause problems.

Package [data-frame], page 15.

Source [conditions.lisp], page 10.

Direct superclasses

warning.

Direct methods

[data-size], page 60.

Direct slots

data-size [Slot]

Initargs :data-size

Readers [data-size], page 60.

Writers *This slot is read-only.*

4.1.7 Structures

bit-variable-summary [Structure]

Summary of a bit vector.

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Direct superclasses

[variable-summary%], page 61.

Direct methods

[print-object], page 44.

Direct slots

count [Slot]

Package common-lisp.

Type alexandria:array-index

Initform 0

Readers [bit-variable-summary-count], page 51.

Writers *This slot is read-only.*

factor-variable-summary [Structure]
 Summary for factor variables

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Direct superclasses
 [variable-summary%], page 61.

Direct methods
 [print-object], page 44.

Direct slots

element-count-alist [Slot]

Type list

Readers [factor-variable-summary-element-count-alist], page 53.

Writers *This slot is read-only.*

generic-variable-summary [Structure]
 Summary for generic variables, i.e. those with mixed types.

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Direct superclasses
 [variable-summary%], page 61.

Direct methods
 [print-object], page 44.

Direct slots

quantiles [Slot]

Type (or null data-frame:real-variable-summary)

Readers [generic-variable-summary-quantiles], page 54.

Writers *This slot is read-only.*

element-count-alist [Slot]

Type list

Readers [generic-variable-summary-element-count-alist], page 53.

Writers *This slot is read-only.*

real-variable-summary [Structure]
 Summary of a real elements (using quantiles).

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Direct superclasses
 [variable-summary%], page 61.

Direct methods
 [print-object], page 44.

Direct slots

min		[Slot]
Package	common-lisp.	
Type	real	
Initform	0	
Readers	[real-variable-summary-min], page 57.	
Writers	<i>This slot is read-only.</i>	
q25		[Slot]
Type	real	
Initform	0	
Readers	[real-variable-summary-q25], page 57.	
Writers	<i>This slot is read-only.</i>	
q50		[Slot]
Type	real	
Initform	0	
Readers	[real-variable-summary-q50], page 57.	
Writers	<i>This slot is read-only.</i>	
mean		[Slot]
Package	alexandria.	
Type	real	
Initform	0	
Readers	[real-variable-summary-mean], page 57.	
Writers	<i>This slot is read-only.</i>	
q75		[Slot]
Type	real	
Initform	0	
Readers	[real-variable-summary-q75], page 57.	
Writers	<i>This slot is read-only.</i>	
max		[Slot]
Package	common-lisp.	
Type	real	
Initform	0	
Readers	[real-variable-summary-max], page 56.	
Writers	<i>This slot is read-only.</i>	

4.1.8 Classes

data [Class]

This class is used for implementing both data-vector and data-frame, and represents an ordered collection of key-column pairs. Columns are not assumed to have any specific attributes. This class is not exported.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

Direct subclasses

- [data-frame], page 48.
- [data-vector], page 49.

Direct methods

- [as-alist], page 43.
- [check-column-compatibility], page 59.
- [element-type], page 43.
- [(setf name)], page 42.
- [name], page 42.

Direct slots

name [Slot]

The name of the data frame. MUST be the same as the symbol whose value cell points to this data frame. This slot essentially allows us to go 'backwards' and get the symbol that names the data frame.

Type string

Initargs nil

Readers [name], page 42.

Writers [(setf name)], page 42.

ordered-keys [Slot]

Type data-frame::ordered-keys

Initargs :ordered-keys

columns [Slot]

Type vector

Initargs :columns

data-frame [Class]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

Direct superclasses

[data], page 48.

Direct methods

- [as-array], page 43.
- [check-column-compatibility], page 59.
- [describe-object], page 43.

- [dims], page 43.
- [drop-missing], page 41.
- [head], page 41.
- [initialize-instance], page 43.
- [missingp], page 42.
- [ncol], page 43.
- [nrow], page 44.
- [print-object], page 44.
- [replace-missing], page 42.
- [select], page 44.
- [tail], page 43.

data-vector [Class]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

Direct superclasses
[data], page 48.

Direct methods

- [as-array], page 43.
- [dims], page 43.
- [print-object], page 44.
- [select], page 44.

4.1.9 Types

data-type () [Type]

A statistical type for a data variable. All data columns must be one of these types if they are to be interpreted properly by Lisp-Stat

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

4.2 Internals

4.2.1 Special variables

data-frames [Special Variable]

Global list of all data frames

Package [data-frame], page 15.

Source [defdf.lisp], page 10.

max-digits [Special Variable]

Package [data-frame], page 15.

Source [pprint.lisp], page 7.

r-default-dataframes [Special Variable]

Data frames corresponding to the default R datasets

Package [rdata], page 19.

Source [rdata.lisp], page 12.

row-numbers-p [Special Variable]

Package [data-frame], page 15.

Source [pprint.lisp], page 7.

student-sleep [Special Variable]

Student's Sleep Data

Package [rdata], page 19.

Source [rdata.lisp], page 12.

4.2.2 Macros

define-data-subclass (*class abbreviation*) [Macro]

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

ensure-plist (*pl*) [Macro]

Package [data-frame], page 15.

Source [plist-aops.lisp], page 12.

4.2.3 Ordinary functions

2d-array-to-list (*array*) [Function]

Convert an array to a list of lists

Package [data-frame], page 15.

Source [pprint.lisp], page 7.

add-key! (*ordered-keys key*) [Function]

Modify ORDERED-KEYS by adding KEY.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

add-keys (*ordered-keys &rest keys*) [Function]

Add KEYS to ORDERED-KEYS

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

aesthetic-string (*thing*) [Function]

Return the string used to represent ‘thing’ when printing aesthetically.

Package [data-frame], page 15.

Source [formatted-output.lisp], page 8.

alist-data (*class alist*) [Function]

Create an object of CLASS (subclass of DATA) from ALIST which contains key-column pairs.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

<code>bit-variable-summary-count</code> (<i>instance</i>)	[Reader]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
Target Slot	
[count], page 45.	
<code>bit-variable-summary-desc</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>bit-variable-summary-length</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>bit-variable-summary-missing</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>bit-variable-summary-name</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>bit-variable-summary-p</code> (<i>object</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>column-type-format</code> (<i>sequence</i>)	[Function]
Return a format string for the most specific type found in sequence Use this for sequences of type T to determine how to format the column.	
Package [data-frame], page 15.	
Source [pprint.lisp], page 7.	
<code>copy-bit-variable-summary</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>copy-factor-variable-summary</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>copy-generic-variable-summary</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>copy-ordered-keys</code> (<i>ordered-keys</i>)	[Function]
Return a copy of ORDERED-KEYS	
Package [data-frame], page 15.	
Source [data-frame.lisp], page 5.	

- copy-real-variable-summary** (*instance*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- copy-variable-summary%** (*instance*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- df-env-p** (*df*) [Function]
Returns T if there is environment set-up for the data frame, or NIL if there isn't one.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- df-exists-p** (*s*) [Function]
Package [data-frame], page 15.
Source [conditions.lisp], page 10.
- distinct** (*column*) [Function]
Returns the number of distinct elements in COLUMN, a symbol naming a variable. Useful for formatting columns for human output.
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- drop-na** (*df*) [Function]
Remove all rows from DF that are missing values. Convenience R-like function.
Package [data-frame], page 15.
Source [missing.lisp], page 11.
- ensure-arguments-alist** (*rest*) [Function]
Recognizes the following and converts them to an alist:
plist
alist
(plist)
(alist)
(data-frame)
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- ensure-not-ratio** (*real*) [Function]
When REAL is a RATIO, convert it to a float, otherwise return as is. Used for printing.
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- factor-variable-summary-desc** (*instance*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.

<code>factor-variable-summary-element-count-alist</code> (<i>instance</i>)	[Reader]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
Target Slot	
[element-count-alist], page 46.	
<code>factor-variable-summary-length</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>factor-variable-summary-missing</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>factor-variable-summary-name</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>factor-variable-summary-p</code> (<i>object</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>generic-variable-summary-desc</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>generic-variable-summary-element-count-alist</code> (<i>instance</i>)	[Reader]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
Target Slot	
[element-count-alist], page 46.	
<code>generic-variable-summary-length</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>generic-variable-summary-missing</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>generic-variable-summary-name</code> (<i>instance</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	
<code>generic-variable-summary-p</code> (<i>object</i>)	[Function]
Package [data-frame], page 15.	
Source [summary.lisp], page 8.	

- generic-variable-summary-quantiles** (*instance*) [Reader]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
Target Slot
[quantiles], page 46.
- get-type** (*x*) [Function]
Return the most specific type symbol for *x*
Package [data-frame], page 15.
Source [utils.lisp], page 5.
- invalid-df-name** (*s*) [Function]
A user prompt, using DUOLOGUE, to select a valid data frame name.
Package [data-frame], page 15.
Source [conditions.lisp], page 10.
- key-index** (*ordered-keys key*) [Function]
Return the index for *KEY*.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- key-list** (*data form*) [Function]
Return a list of keys used in *REST*, a form
Package [data-frame], page 15.
Source [filter.lisp], page 11.
- keys-count** (*ordered-keys*) [Function]
Number of keys.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- keys-vector** (*ordered-keys*) [Function]
Vector of all keys.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- make-bit-variable-summary** (*&key length missing name desc count*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- make-data** (*class keys columns*) [Function]
Create a DATA object from *KEYS* and *COLUMNS*. FOR INTERNAL USE. Always creates a copy of *COLUMNS* in order to ensure that it is an adjustable array with a fill pointer. *KEYS* are converted to ORDERED-KEYS if necessary.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.

- make-factor-variable-summary** (**&key** *length missing name desc element-count-alist*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- make-generic-variable-summary** (**&key** *length missing name desc quantiles element-count-alist*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- make-ordered-keys** (**&key** *table*) [Function]
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- make-real-variable-summary** (**&key** *length missing name desc min q25 q50 mean q75 max*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- make-variable-summary%** (**&key** *length missing name desc*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- max-decimal** (*sequence &optional max-digits*) [Function]
 Return the maximum number of digits to the right of the decimal point in the numbers of SEQUENCE, equal to or less than MAX-DIGITS
Package [data-frame], page 15.
Source [pprint.lisp], page 7.
- max-width** (*sequence &optional max-width*) [Function]
 Return the largest printed string size of the elements of SEQUENCE, equal to or less than MAX-WIDTH
Package [data-frame], page 15.
Source [pprint.lisp], page 7.
- monotonicp** (*column*) [Function]
 Returns T if all elements of COLUMN, a SYMBOL, are increasing monotonically Useful for detecting row numbers in imported data.
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- ordered-keys** (*keys*) [Function]
 Create an ORDERED-KEYS object from KEYS (a sequence).
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- ordered-keys-p** (*object*) [Function]
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.

- ordered-keys-table** (*instance*) [Reader]
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
Target Slot
[table], page 61.
- plist-data** (*class plist*) [Function]
Create an object of CLASS (subclass of DATA) from PLIST which contains keys and columns, interleaved.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- print-count-and-percentage** (*stream count length*) [Function]
Print COUNT as is and also as a rounded percentage
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- print-table** (*rows &optional stream*) [Function]
Print ROWS as a nicely-formatted table.
Each row should have the same number of columns.
Columns will be justified properly to fit the longest item in each one. Example:
(print-table '((1 :red something)
(2 :green more)))
=>
1 | RED | SOMETHING
2 | GREEN | MORE
Package [data-frame], page 15.
Source [formatted-output.lisp], page 8.
- printer-status** () [Function]
Print values of all the printer variables
Package [data-frame], page 15.
Source [pprint.lisp], page 7.
- real-variable-summary-desc** (*instance*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- real-variable-summary-length** (*instance*) [Function]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- real-variable-summary-max** (*instance*) [Reader]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
Target Slot
[max], page 47.

- real-variable-summary-mean** (*instance*) [Reader]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
 Target Slot
 [mean], page 47.
- real-variable-summary-min** (*instance*) [Reader]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
 Target Slot
 [min], page 47.
- real-variable-summary-missing** (*instance*) [Function]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
- real-variable-summary-name** (*instance*) [Function]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
- real-variable-summary-p** (*object*) [Function]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
- real-variable-summary-q25** (*instance*) [Reader]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
 Target Slot
 [q25], page 47.
- real-variable-summary-q50** (*instance*) [Reader]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
 Target Slot
 [q50], page 47.
- real-variable-summary-q75** (*instance*) [Reader]
 Package [data-frame], page 15.
 Source [summary.lisp], page 8.
 Target Slot
 [q75], page 47.
- remove-columns!** (*data &rest keys*) [Function]
 Modify DATA (a data-frame or data-vector) by removing columns with keys. If a data-frame environment exists, add columns to it as well.
 Package [data-frame], page 15.
 Source [data-frame.lisp], page 5.

- remove-key!** (*ordered-keys key*) [Function]
 Modify ORDERED-KEYS by removing KEY.
Package [data-frame], page 15.
Source [data-frame.lisp], page 5.
- reverse-df** (*df*) [Function]
 Return DF with columns in reverse order
Package [data-frame], page 15.
Source [pprint.lisp], page 7.
- show-properties** (*df*) [Function]
 Show the standard properties of the variables of the data frame DF Standard properties are 'label', 'type' and 'unit'
Package [data-frame], page 15.
Source [properties.lisp], page 11.
- show-symbols** (*pkg*) [Function]
 Print all symbols in PKG Example: (show-symbols 'mtcars)
Package [data-frame], page 15.
Source [defdf.lisp], page 10.
- summarize-factor-variable** (*column*) [Function]
 Return an alist of factor/count pairs
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- summarize-generic-variable** (*column &optional name*) [Function]
 Return an object that summarizes COLUMN of a DATA-FRAME. Primarily intended for printing, not analysis, returned values should print nicely. This function can be used on any type of column, even one with mixed types
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- summarize-real-variable** (*column*) [Function]
 Return a summary for a float variable
Package [data-frame], page 15.
Source [summary.lisp], page 8.
- types-in-column** (*seq*) [Function]
 Return a list of the types found in SEQ
Package [data-frame], page 15.
Source [utils.lisp], page 5.
- variable-summary%-desc** (*instance*) [Reader]
Package [data-frame], page 15.
Source [summary.lisp], page 8.
Target Slot
 [desc], page 62.

`variable-summary%-length` (*instance*) [Reader]

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Target Slot
[length], page 61.

`variable-summary%-missing` (*instance*) [Reader]

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Target Slot
[missing], page 62.

`variable-summary%-name` (*instance*) [Reader]

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Target Slot
[name], page 62.

`variable-summary%-p` (*object*) [Function]

Package [data-frame], page 15.

Source [summary.lisp], page 8.

`weave` (&rest *lists*) [Function]

Return a list whose elements alternate between each of the lists ‘lists’. Weaving stops when any of the lists has been exhausted.

Package [data-frame], page 15.

Source [formatted-output.lisp], page 8.

4.2.4 Generic functions

`check-column-compatibility` (*data column*) [Generic Function]

Check if COLUMN is compatible with DATA.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

Methods

`check-column-compatibility` ((*data* [data-frame],
page 48) *column*) [Method]

`check-column-compatibility` ((*data* [data], page 48)
column) [Method]

`column-length` (*column*) [Generic Function]

Return the length of column.

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Methods

	<code>column-length</code> ((<i>column vector</i>))	[Method]
<code>data-size</code> (<i>condition</i>)		[Generic Reader]
Package	[data-frame], page 15.	
Methods		
	<code>data-size</code> ((<i>condition</i> [<i>large-data</i>], page 45))	[Reader Method]
Source	[conditions.lisp], page 10.	
Target Slot		
	[data-size], page 45.	
<code>default-column-formats</code> (<i>array</i>)		[Generic Function]
Package	[data-frame], page 15.	
Methods		
	<code>default-column-formats</code> ((<i>array simple-array</i>))	[Method]
	Return a list of formatting strings for ARRAY	
	The method returns a set of default formatting strings using heuristics.	
Source	[pprint.lisp], page 7.	

4.2.5 Conditions

<code>data-frame-exists</code>		[Condition]
	An attempt to redefine an existing data frame. Triggered if either the symbol is bound or the package exists.	
Package	[data-frame], page 15.	
Source	[conditions.lisp], page 10.	
Direct superclasses		
	error.	
Direct methods		
	[data-frame], page 41.	
Direct slots		
	<code>data-frame</code>	[Slot]
	Initargs :data-frame	
	Readers [data-frame], page 41.	
	Writers <i>This slot is read-only.</i>	
<code>missing-data</code>		[Condition]
	A variable has missing data, e.g. :na, nil	
Package	[data-frame], page 15.	
Source	[conditions.lisp], page 10.	
Direct superclasses		
	error.	
Direct slots		
	<code>name</code>	[Slot]
	Initargs :name	
	<code>data</code>	[Slot]
	Initargs :data	

4.2.6 Structures

ordered-keys [Structure]

Representation of ordered keys

Ordered keys provide a mapping from column keys (symbols) to nonnegative integers. They are used internally and the corresponding interface is NOT EXPORTED.

TABLE maps keys to indexes, starting from zero.

Package [data-frame], page 15.

Source [data-frame.lisp], page 5.

Direct superclasses

structure-object.

Direct methods

- [axis-dimension], page 43.
- [canonical-representation], page 43.
- [print-object], page 44.
- [select], page 44.

Direct slots

table	[Slot]
Type	hash-table
Initform	(make-hash-table :test (function eq))
Readers	[ordered-keys-table], page 56.
Writers	<i>This slot is read-only.</i>

variable-summary% [Structure]

Base class for summarizing variables. Summary functions take SYMBOLs, rather than values, because the symbol property lists naming the variables have meta-data, e.g. type, label, that we want to print. Not exported.

Package [data-frame], page 15.

Source [summary.lisp], page 8.

Direct superclasses

structure-object.

Direct subclasses

- [bit-variable-summary], page 45.
- [factor-variable-summary], page 46.
- [generic-variable-summary], page 46.
- [real-variable-summary], page 46.

Direct slots

length	[Slot]
Package	common-lisp.
Type	alexandria:array-index
Initform	0
Readers	[variable-summary%-length], page 59.
Writers	<i>This slot is read-only.</i>

missing		[Slot]
Type	fixnum	
Initform	0	
Readers	[variable-summary%-missing], page 59.	
Writers	<i>This slot is read-only.</i>	
name		[Slot]
Type	string	
Initform	""	
Readers	[variable-summary%-name], page 59.	
Writers	<i>This slot is read-only.</i>	
desc		[Slot]
Type	string	
Initform	""	
Readers	[variable-summary%-desc], page 58.	
Writers	<i>This slot is read-only.</i>	

Appendix A Indexes

A.1 Concepts

(Index is nonexistent)

A.2 Functions

(
(setf column)	35
(setf name)	42

2

2d-array-to-list	50
------------------------	----

A

add-column!	34
add-columns	34
add-columns!	34
add-key!	50
add-keys	50
aesthetic-string	50
alist-data	50
alist-df	34
alist-dv	34
as-alist	43
as-array	43
axis-dimension	43

B

bit-variable-summary-count	51
bit-variable-summary-desc	51
bit-variable-summary-length	51
bit-variable-summary-missing	51
bit-variable-summary-name	51
bit-variable-summary-p	51

C

canonical-representation	43
check-column-compatibility	59
column	34
column-length	59, 60
column-names	35
column-type	35
column-type-format	51
columns	35
copy	35
copy-bit-variable-summary	51
copy-factor-variable-summary	51
copy-generic-variable-summary	51
copy-ordered-keys	51
copy-real-variable-summary	52
copy-variable-summary%	52
count-rows	35

D

data	35
data-frame	41
data-size	60
default-column-formats	60
defdf	34
defdf-env	36
define-data-subclass	50
delete-nth	36
delete-nth*	34
describe-object	43
df	36
df-env-p	52
df-exists-p	52
df-print	36
df-remove-duplicates	36
dims	43
distinct	52
do-rows	36
drop-missing	41
drop-na	52
dv	36

E

element-type	43
ensure-arguments-alist	52
ensure-not-ratio	52
ensure-plist	50

F

factor-variable-summary-desc	52
factor-variable-summary-	
element-count-alist	53
factor-variable-summary-length	53
factor-variable-summary-missing	53
factor-variable-summary-name	53
factor-variable-summary-p	53
filter-rows	36
Function, (setf column)	35
Function, 2d-array-to-list	50
Function, add-column!	34
Function, add-columns	34
Function, add-columns!	34
Function, add-key!	50
Function, add-keys	50
Function, aesthetic-string	50
Function, alist-data	50
Function, alist-df	34
Function, alist-dv	34
Function, bit-variable-summary-count	51
Function, bit-variable-summary-desc	51
Function, bit-variable-summary-length	51
Function, bit-variable-summary-missing	51
Function, bit-variable-summary-name	51
Function, bit-variable-summary-p	51
Function, column	34
Function, column-names	35
Function, column-type	35
Function, column-type-format	51

Function, columns	35	Function, max-decimal	55
Function, copy	35	Function, max-width	55
Function, copy-bit-variable-summary	51	Function, monotonicp	55
Function, copy-factor-variable-summary	51	Function, ordered-keys	55
Function, copy-generic-variable-summary	51	Function, ordered-keys-p	55
Function, copy-ordered-keys	51	Function, ordered-keys-table	56
Function, copy-real-variable-summary	52	Function, plist-data	56
Function, copy-variable-summary%	52	Function, plist-df	38
Function, count-rows	35	Function, plist-dv	38
Function, data	35	Function, print-array	39
Function, defdf-env	36	Function, print-count-and-percentage	56
Function, delete-nth	36	Function, print-data	39
Function, df	36	Function, print-markdown	39
Function, df-env-p	52	Function, print-table	56
Function, df-exists-p	52	Function, printer-status	56
Function, df-print	36	Function, real-variable-summary-desc	56
Function, df-remove-duplicates	36	Function, real-variable-summary-length	56
Function, distinct	52	Function, real-variable-summary-max	56
Function, do-rows	36	Function, real-variable-summary-mean	57
Function, drop-na	52	Function, real-variable-summary-min	57
Function, dv	36	Function, real-variable-summary-missing	57
Function, ensure-arguments-alist	52	Function, real-variable-summary-name	57
Function, ensure-not-ratio	52	Function, real-variable-summary-p	57
Function, factor-variable-summary-desc	52	Function, real-variable-summary-q25	57
Function, factor-variable-summary- element-count-alist	53	Function, real-variable-summary-q50	57
Function, factor-variable-summary-length	53	Function, real-variable-summary-q75	57
Function, factor-variable-summary-missing	53	Function, remove-column!	39
Function, factor-variable-summary-name	53	Function, remove-columns	39
Function, factor-variable-summary-p	53	Function, remove-columns!	57
Function, filter-rows	36	Function, remove-key!	58
Function, generic-variable-summary-desc	53	Function, replace-column	39
Function, generic-variable-summary- element-count-alist	53	Function, replace-column!	39
Function, generic-variable-summary-length	53	Function, reverse-df	58
Function, generic-variable-summary-missing	53	Function, rows	39
Function, generic-variable-summary-name	53	Function, set-properties	40
Function, generic-variable-summary-p	53	Function, set-property	40
Function, generic-variable-summary-quantiles	54	Function, short-string	40
Function, get-property	37	Function, show-data-frames	40
Function, get-summaries	37	Function, show-properties	58
Function, get-type	54	Function, show-symbols	58
Function, heuristic-type-types	37	Function, summarize-column	40
Function, ignore-missing	37	Function, summarize-factor-variable	58
Function, invalid-df-name	54	Function, summarize-generic-variable	58
Function, key-index	54	Function, summarize-real-variable	58
Function, key-list	54	Function, summary	40
Function, keys	37	Function, types-in-column	58
Function, keys-count	54	Function, undef	40
Function, keys-vector	54	Function, variable-summary%-desc	58
Function, make-bit-variable-summary	54	Function, variable-summary%-length	59
Function, make-data	54	Function, variable-summary%-missing	59
Function, make-df	38	Function, variable-summary%-name	59
Function, make-dv	38	Function, variable-summary%-p	59
Function, make-factor-variable-summary	55	Function, weave	59
Function, make-generic-variable-summary	55		
Function, make-ordered-keys	55		
Function, make-real-variable-summary	55		
Function, make-variable-summary%	55		
Function, map-columns	38		
Function, map-df	38		
Function, map-rows	38		
Function, mask-rows	38		
Function, matrix-df	38		

G

Generic Function, (setf name)	42
Generic Function, check-column-compatibility	59
Generic Function, column-length	59
Generic Function, data-frame	41
Generic Function, data-size	60
Generic Function, default-column-formats	60
Generic Function, drop-missing	41
Generic Function, head	41
Generic Function, missingp	41
Generic Function, name	42
Generic Function, rename-column!	42
Generic Function, replace-missing	42
Generic Function, tail	42
generic-variable-summary-desc	53
generic-variable-summary- element-count-alist	53
generic-variable-summary-length	53
generic-variable-summary-missing	53
generic-variable-summary-name	53
generic-variable-summary-p	53
generic-variable-summary-quantiles	54
get-property	37
get-summaries	37
get-type	54

H

head	41
heuristicate-types	37

I

ignore-missing	37
initialize-instance	43
invalid-df-name	54

K

key-index	54
key-list	54
keys	37
keys-count	54
keys-vector	54

M

Macro, defdf	34
Macro, define-data-subclass	50
Macro, delete-nth*	34
Macro, ensure-plist	50
make-bit-variable-summary	54
make-data	54
make-df	38
make-dv	38
make-factor-variable-summary	55
make-generic-variable-summary	55
make-ordered-keys	55
make-real-variable-summary	55
make-variable-summary%	55
map-columns	38
map-df	38
map-rows	38

mask-rows	38
matrix-df	38
max-decimal	55
max-width	55
Method, (setf name)	42
Method, as-alist	43
Method, as-array	43
Method, axis-dimension	43
Method, canonical-representation	43
Method, check-column-compatibility	59
Method, column-length	60
Method, data-frame	41
Method, data-size	60
Method, default-column-formats	60
Method, describe-object	43
Method, dims	43
Method, drop-missing	41
Method, element-type	43
Method, head	41
Method, initialize-instance	43
Method, missingp	42
Method, name	42
Method, ncol	43
Method, nrow	44
Method, print-object	44
Method, rename-column!	42
Method, replace-missing	42
Method, select	44
Method, tail	43
missingp	41, 42
monotonicp	55

N

name	42
ncol	43
nrow	44

O

ordered-keys	55
ordered-keys-p	55
ordered-keys-table	56

P

plist-data	56
plist-df	38
plist-dv	38
print-array	39
print-count-and-percentage	56
print-data	39
print-markdown	39
print-object	44
print-table	56
printer-status	56

R

real-variable-summary-desc	56
real-variable-summary-length	56
real-variable-summary-max	56
real-variable-summary-mean	57
real-variable-summary-min	57
real-variable-summary-missing	57
real-variable-summary-name	57
real-variable-summary-p	57
real-variable-summary-q25	57
real-variable-summary-q50	57
real-variable-summary-q75	57
remove-column!	39
remove-columns	39
remove-columns!	57
remove-key!	58
rename-column!	42
replace-column	39
replace-column!	39
replace-missing	42
reverse-df	58
rows	39

S

select	44
set-properties	40
set-property	40
short-string	40
show-data-frames	40

show-properties	58
show-symbols	58
summarize-column	40
summarize-factor-variable	58
summarize-generic-variable	58
summarize-real-variable	58
summary	40

T

tail	42, 43
types-in-column	58

U

undef	40
-------------	----

V

variable-summary%-desc	58
variable-summary%-length	59
variable-summary%-missing	59
variable-summary%-name	59
variable-summary%-p	59

W

weave	59
-------------	----

A.3 Variables

*

ask-on-redefine	23
data-frames	49
distinct-maximum	23
distinct-threshold	23
large-data	23
max-digits	49
quantile-threshold	23
r-default-dataframes	49
r-default-datasets	23
row-numbers-p	50
summary-minimum-length	23

A

ability.cov	24
airmiles	24
airpassengers	24
airquality	24
anscombe	24
attenu	24
attitude	24
austres	24

B

base-url	24
bjsales	25
bod	25

C

cars	25
chickweight	25
chickwts	25
co2-1	25
co2-2	25
columns	48
count	45
crimtab	25

D

data	60
data-frame	60
data-size	45
desc	62
discoveries	25
dnase	26

E

element-count-alist	46
esoph	26
euro	26
eustockmarkets	26

F

faithful	26
formaldehyde	26
freeny	26

H

haireyecolor	26
harman23.cor	26
harman74.cor	27

I

index	27
indometh	27
infert	27
insectsprays	27
iris	27
iris3	27
islands	27

J

johnsonjohnson	27
----------------	----

K

key	44, 45
keys	45

L

lakehuron	27
length	61
lh	28
lifecyclesavings	28
loblolly	28
longley	28
lynx	28

M

max	47
mean	47
min	47
missing	62
morley	28
mpg	28
mtcars	28

N

name	48, 60, 62
nhtemp	28
nile	29
nottem	29
npk	29
nycflights13-airlines	29
nycflights13-airports	29
nycflights13-flights	29
nycflights13-planes	29
nycflights13-weather	29

O

occupationalstatus	29
orange	30
orchardsprays	30
ordered-keys	48

P

plantgrowth	30
precip	30
presidents	30
pressure	30
puromycin	30

Q

q25	47
q50	47
q75	47
quakes	30
quantiles	46

R

randu	30
rivers	31
rock	31

S

seatbelts	31
Slot, columns	48
Slot, count	45
Slot, data	60
Slot, data-frame	60
Slot, data-size	45
Slot, desc	62
Slot, element-count-alist	46
Slot, key	44, 45
Slot, keys	45
Slot, length	61
Slot, max	47
Slot, mean	47
Slot, min	47
Slot, missing	62
Slot, name	48, 60, 62
Slot, ordered-keys	48
Slot, q25	47
Slot, q50	47
Slot, q75	47

Slot, quantiles	46
Slot, table	61
Special Variable, *ask-on-redefine*	23
Special Variable, *data-frames*	49
Special Variable, *distinct-maximum*	23
Special Variable, *distinct-threshold*	23
Special Variable, *large-data*	23
Special Variable, *max-digits*	49
Special Variable, *quantile-threshold*	23
Special Variable, *r-default-dataframes*	49
Special Variable, *r-default-datasets*	23
Special Variable, *row-numbers-p*	50
Special Variable, *summary-minimum-length*	23
Special Variable, ability.cov	24
Special Variable, airmiles	24
Special Variable, airpassengers	24
Special Variable, airquality	24
Special Variable, anscombe	24
Special Variable, attenu	24
Special Variable, attitude	24
Special Variable, austres	24
Special Variable, base-url	24
Special Variable, bjsales	25
Special Variable, bod	25
Special Variable, cars	25
Special Variable, chickweight	25
Special Variable, chickwts	25
Special Variable, co2-1	25
Special Variable, co2-2	25
Special Variable, crimtab	25
Special Variable, discoveries	25
Special Variable, dnase	26
Special Variable, esoph	26
Special Variable, euro	26
Special Variable, eustockmarkets	26
Special Variable, faithful	26
Special Variable, formaldehyde	26
Special Variable, freeny	26
Special Variable, haireyecolor	26
Special Variable, harman23.cor	26
Special Variable, harman74.cor	27
Special Variable, index	27
Special Variable, indometh	27
Special Variable, infert	27
Special Variable, insectsprays	27
Special Variable, iris	27
Special Variable, iris3	27
Special Variable, islands	27
Special Variable, johnsonjohnson	27
Special Variable, lakehuron	27
Special Variable, lh	28
Special Variable, lifecyclesavings	28
Special Variable, loblolly	28
Special Variable, longley	28
Special Variable, lynx	28
Special Variable, morley	28
Special Variable, mpg	28
Special Variable, mtcars	28
Special Variable, nhtemp	28
Special Variable, nile	29
Special Variable, nottem	29
Special Variable, npk	29
Special Variable, nycflights13-airlines	29
Special Variable, nycflights13-airports	29
Special Variable, nycflights13-flights	29

Special Variable, <code>nycflights13-planes</code>	29
Special Variable, <code>nycflights13-weather</code>	29
Special Variable, <code>occupationalstatus</code>	29
Special Variable, <code>orange</code>	30
Special Variable, <code>orchardsprays</code>	30
Special Variable, <code>plantgrowth</code>	30
Special Variable, <code>precip</code>	30
Special Variable, <code>presidents</code>	30
Special Variable, <code>pressure</code>	30
Special Variable, <code>puromycin</code>	30
Special Variable, <code>quakes</code>	30
Special Variable, <code>randu</code>	30
Special Variable, <code>rivers</code>	31
Special Variable, <code>rock</code>	31
Special Variable, <code>seatbelts</code>	31
Special Variable, <code>stackloss</code>	31
Special Variable, <code>student-sleep</code>	50
Special Variable, <code>sunspot.month</code>	31
Special Variable, <code>sunspot.year</code>	31
Special Variable, <code>sunspots</code>	31
Special Variable, <code>swiss</code>	31
Special Variable, <code>theoph</code>	31
Special Variable, <code>titanic</code>	32
Special Variable, <code>toothgrowth</code>	32
Special Variable, <code>treering</code>	32
Special Variable, <code>trees</code>	32
Special Variable, <code>ucbadmissions</code>	32
Special Variable, <code>ukdriverdeaths</code>	32
Special Variable, <code>ukgas</code>	32
Special Variable, <code>usaccdeaths</code>	32
Special Variable, <code>usarrests</code>	32
Special Variable, <code>usjudgeratings</code>	33
Special Variable, <code>uspersonalexpenditure</code>	33
Special Variable, <code>uspop</code>	33
Special Variable, <code>vadeaths</code>	33
Special Variable, <code>volcano</code>	33
Special Variable, <code>warpbreaks</code>	33
Special Variable, <code>women</code>	33
Special Variable, <code>worldphones</code>	33

Special Variable, <code>wwwusage</code>	33
<code>stackloss</code>	31
<code>student-sleep</code>	50
<code>sunspot.month</code>	31
<code>sunspot.year</code>	31
<code>sunspots</code>	31
<code>swiss</code>	31

T

<code>table</code>	61
<code>theoph</code>	31
<code>titanic</code>	32
<code>toothgrowth</code>	32
<code>treering</code>	32
<code>trees</code>	32

U

<code>ucbadmissions</code>	32
<code>ukdriverdeaths</code>	32
<code>ukgas</code>	32
<code>usaccdeaths</code>	32
<code>usarrests</code>	32
<code>usjudgeratings</code>	33
<code>uspersonalexpenditure</code>	33
<code>uspop</code>	33

V

<code>vadeaths</code>	33
<code>volcano</code>	33

W

<code>warpbreaks</code>	33
<code>women</code>	33
<code>worldphones</code>	33
<code>wwwusage</code>	33

A.4 Data types

B

bit-variable-summary 45

C

Class, data 48
 Class, data-frame 48
 Class, data-vector 49
 Condition, data-frame-exists 60
 Condition, duplicate-key 44
 Condition, key-not-found 45
 Condition, large-data 45
 Condition, missing-data 60
 conditions.lisp 10

D

data 48
 data-frame 3, 15, 48
 data-frame-exists 60
 data-frame.asd 5
 data-frame.lisp 5
 data-type 49
 data-vector 49
 data.lisp 12
 defdf.lisp 10
 duplicate-key 44

F

factor-variable-summary 46
 File, conditions.lisp 10
 File, data-frame.asd 5
 File, data-frame.lisp 5
 File, data.lisp 12
 File, defdf.lisp 10
 File, filter.lisp 11
 File, formatted-output.lisp 8
 File, missing.lisp 11
 File, pkgdcl.lisp 5
 File, plist-aops.lisp 12
 File, pprint.lisp 7
 File, properties.lisp 11
 File, rdata.lisp 12
 File, summary.lisp 8
 File, utils.lisp 5
 filter.lisp 11
 formatted-output.lisp 8

G

generic-variable-summary 46

K

key-not-found 45

L

large-data 45

M

missing-data 60
 missing.lisp 11

O

ordered-keys 61

P

Package, data-frame 15
 Package, rdata 19
 pkgdcl.lisp 5
 plist-aops.lisp 12
 pprint.lisp 7
 properties.lisp 11

R

rdata 19
 rdata.lisp 12
 real-variable-summary 46

S

Structure, bit-variable-summary 45
 Structure, factor-variable-summary 46
 Structure, generic-variable-summary 46
 Structure, ordered-keys 61
 Structure, real-variable-summary 46
 Structure, variable-summary% 61
 summary.lisp 8
 System, data-frame 3

T

Type, data-type 49

U

utils.lisp 5

V

variable-summary% 61