The Lisp-Stat Reference Manual

Statistical Computing in Common Lisp, version 1.0.0

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Table of Contents

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1 Systems

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

1.1 lisp-stat

A statistical computing environment for Common Lisp

Long Name
Statistical Computing in Common Lisp

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Home Page
https://lisp-stat.dev/

Source Control
(GIT https://github.com/Lisp-Stat/lisp-stat.git)

Bug Tracker
https://github.com/Lisp-Stat/lisp-stat/issues

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Long Description
The Lisp-Stat system is an umbrella for a few projects and provides a unified interface for working with statistics. The general rule is that Lisp-Stat may depend on other libraries, for example data-frame, but not the other way around. Lisp-Stat provides it's own user package, LS-USER, which imports CL as well as the symbols we need from the other libraries. You should always do your work in the LS-USER package, and not in CL-USER.

Version 1.0.0

Dependencies
- alexandria (system).
- let-plus (system).
- array-operations (system).
- data-frame (system).
- dfio (system).
- num-utils (system).
- select (system).
- dexador (system).
- split-sequence (system).

Source [lisp-stat.asd], page 7.

Child Components
- [pkgdcls.lisp], page 7 (file).
- [license], page 11 (file).
- [base], page 5 (module).
- [statistics], page 5 (module).
- [docs], page 5 (module).
- [ls-init.lisp], page 10 (file).

2 Modules

Modules are listed depth-first from the system components tree.

2.1 lisp-stat/base

Source [lisp-stat.asd], page 7.

Parent Component
[lisp-stat], page 3 (system).

Child Components
- [variables.lisp], page 7 (file).
- [data.lisp], page 7 (file).
- [rdata.lisp], page 8 (file).

2.2 lisp-stat/statistics

Source [lisp-stat.asd], page 7.

Parent Component
[lisp-stat], page 3 (system).

Child Component
[stats.lisp], page 10 (file).

2.3 lisp-stat/docs

Source [lisp-stat.asd], page 7.

Parent Component
[lisp-stat], page 3 (system).

Child Component
[doc-strings.lisp], page 10 (file).

3 Files

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

3.1 Lisp

3.1.1 lisp-stat/lisp-stat.asd

Source [lisp-stat.asd], page 7.

Parent Component
[lisp-stat], page 3 (system).

ASDF Systems
[lisp-stat], page 3.

3.1.2 lisp-stat/pkgdcls.lisp

Source [lisp-stat.asd], page 7.

Parent Component
[lisp-stat], page 3 (system).

Packages [lisp-stat], page 13.

3.1.3 lisp-stat/base/variables.lisp

Source [lisp-stat.asd], page 7.

Parent Component
[base], page 5 (module).

Public Interface

- [def], page 27 (macro).
- [savevar], page 28 (function).
- [undef-var], page 28 (function).
- [variables], page 28 (function).

Internals

- [*variables*], page 29 (special variable).
- [save-obj], page 32 (generic function).

3.1.4 lisp-stat/base/data.lisp

Dependency
[variables.lisp], page 7 (file).

Source [lisp-stat.asd], page 7.

Parent Component
[base], page 5 (module).

Public Interface
[data], page 27 (function).

3.1.5 lisp-stat/base/rdata.lisp

Dependency
[data.lisp], page 7 (file).

Source [lisp-stat.asd], page 7.

Parent Component
[base], page 5 (module).

Packages [rdata], page 14.

Public Interface

- [*r-default-datasets*], page 17 (special variable).
- [ability.cov], page 17 (special variable).
- [airmiles], page 17 (special variable).
- [airpassengers], page 17 (special variable).
- [airquality], page 17 (special variable).
- [anscombe], page 17 (special variable).
- [attenu], page 17 (special variable).
- [attitude], page 17 (special variable).
- [austres], page 18 (special variable).
- [base-url], page 18 (special variable).
- [bjsales], page 18 (special variable).
- [bod], page 18 (special variable).
- [cars], page 18 (special variable).
- [chickweight], page 18 (special variable).
- [chickwts], page 18 (special variable).
- [co2-1], page 18 (special variable).
- [co2-2], page 18 (special variable).
- [crimtab], page 19 (special variable).
- [discoveries], page 19 (special variable).
- [dnase], page 19 (special variable).
- [esoph], page 19 (special variable).
- [euro], page 19 (special variable).
- [eustockmarkets], page 19 (special variable).
- [faithful], page 19 (special variable).
- [formaldehyde], page 19 (special variable).
- [freeny], page 19 (special variable).
- [haireyecolor], page 20 (special variable).
- [harman23.cor], page 20 (special variable).
- [harman74.cor], page 20 (special variable).
- [index], page 20 (special variable).
- [indometh], page 20 (special variable).
- [infert], page 20 (special variable).
- [insectsprays], page 20 (special variable).
- [iris], page 20 (special variable).

- [theoph], page 25 (special variable).
- [titanic], page 25 (special variable).
- [toothgrowth], page 25 (special variable).
- [treering], page 25 (special variable).
- [trees], page 25 (special variable).
- [ucbadmissions], page 25 (special variable).
- [ukdriverdeaths], page 25 (special variable).
- [ukgas], page 25 (special variable).
- [usaccdeaths], page 26 (special variable).
- [usarrests], page 26 (special variable).
- [usjudgeratings], page 26 (special variable).
- [uspersonalexpenditure], page 26 (special variable).
- [uspop], page 26 (special variable).
- [vadeaths], page 26 (special variable).
- [volcano], page 26 (special variable).
- [warpbreaks], page 26 (special variable).
- [women], page 26 (special variable).
- [worldphones], page 27 (special variable).
- [wwwusage], page 27 (special variable).

Internals

- [*r-default-dataframes*], page 29 (special variable).
- [student-sleep], page 30 (special variable).

3.1.6 lisp-stat/statistics/stats.lisp

Source [lisp-stat.asd], page 7.

Parent Component
[statistics], page 5 (module).

Public Interface

- [fivenum], page 27 (function).
- [interquartile-range], page 28 (function).

3.1.7 lisp-stat/docs/doc-strings.lisp

Source [lisp-stat.asd], page 7.

Parent Component
[docs], page 5 (module).

3.1.8 lisp-stat/ls-init.lisp

Source [lisp-stat.asd], page 7.

Parent Component
[lisp-stat], page 3 (system).

Packages [ls-user], page 13.

Internals [setup-ls-translations], page 32 (function).

3.2 Static

3.2.1 `lisp-stat/license`

Source [`lisp-stat.asd`], page 7.

Parent Component
[`lisp-stat`], page 3 (system).

4 Packages

Packages are listed by definition order.

4.1 lisp-stat

Base functions for Lisp-Stat

Source [pkgdcls.lisp], page 7.

Nickname ls

Use List

- alexandria.
- array-operations/all.
- common-lisp.
- data-frame.
- dfio.
- num-utils.arithmetic.
- num-utils.elementwise.
- num-utils.print-matrix.
- num-utils.statistics.
- num-utils.utilities.
- select.
- split-sequence.

Used By List

[ls-user], page 13.

Public Interface

- [data], page 27 (function).
- [def], page 27 (macro).
- [fivenum], page 27 (function).
- [interquartile-range], page 28 (function).
- [savevar], page 28 (function).
- [undef-var], page 28 (function).
- [variables], page 28 (function).

Internals

- [*variables*], page 29 (special variable).
- [save-obj], page 32 (generic function).
- [setup-ls-translations], page 32 (function).

4.2 ls-user

User package for Lisp-Stat

Source [ls-init.lisp], page 10.

Use List

- common-lisp.
- [lisp-stat], page 13.

Internals

- [iris], page 29 (special variable).
- [mtcars], page 29 (special variable).
- [plant-growth], page 30 (special variable).
- [tooth-growth], page 30 (special variable).
- [usarrests], page 31 (special variable).

4.3 rdata

Source [rdata.lisp], page 8.

Use List common-lisp.

Public Interface

- [*r-default-datasets*], page 17 (special variable).
- [ability.cov], page 17 (special variable).
- [airmiles], page 17 (special variable).
- [airpassengers], page 17 (special variable).
- [airquality], page 17 (special variable).
- [anscombe], page 17 (special variable).
- [attenu], page 17 (special variable).
- [attitude], page 17 (special variable).
- [austres], page 18 (special variable).
- [base-url], page 18 (special variable).
- [bjsales], page 18 (special variable).
- [bod], page 18 (special variable).
- [cars], page 18 (special variable).
- [chickweight], page 18 (special variable).
- [chickwts], page 18 (special variable).
- [co2-1], page 18 (special variable).
- [co2-2], page 18 (special variable).
- [crimtab], page 19 (special variable).
- [discoveries], page 19 (special variable).
- [dnase], page 19 (special variable).
- [esoph], page 19 (special variable).
- [euro], page 19 (special variable).
- [eustockmarkets], page 19 (special variable).
- [faithful], page 19 (special variable).
- [formaldehyde], page 19 (special variable).
- [freeny], page 19 (special variable).
- [haireyecolor], page 20 (special variable).
- [harman23.cor], page 20 (special variable).
- [harman74.cor], page 20 (special variable).
- [index], page 20 (special variable).
- [indometh], page 20 (special variable).

5 Definitions

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

5.1 Public Interface

5.1.1 Special variables

`*r-default-datasets*` [Special Variable]
All data sets included by default in R

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`ability.cov` [Special Variable]
Ability and Intelligence Tests

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`airmiles` [Special Variable]
Passenger Miles on Commercial US Airlines, 1937-1960

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`airpassengers` [Special Variable]
Monthly Airline Passenger Numbers 1949-1960

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`airquality` [Special Variable]
New York Air Quality Measurements

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`anscombe` [Special Variable]
Anscombe's Quartet of 'Identical' Simple Linear Regressions

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`attenu` [Special Variable]
The Joyner-Boore Attenuation Data

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`attitude` [Special Variable]
The Chatterjee-Price Attitude Data

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`austres` [Special Variable]
Quarterly Time Series of the Number of Australian Residents

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`base-url` [Special Variable]
Base URL for datasets included in R

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`bjsales` [Special Variable]
Sales Data with Leading Indicator

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`bod` [Special Variable]
Biochemical Oxygen Demand

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`cars` [Special Variable]
Speed and Stopping Distances of Cars

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`chickweight` [Special Variable]
Weight versus age of chicks on different diets

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`chickwts` [Special Variable]
Chicken Weights by Feed Type

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`co2-1` [Special Variable]
Carbon Dioxide Uptake in Grass Plants

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`co2-2` [Special Variable]
Mauna Loa Atmospheric CO2 Concentration

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`crimtab` [Special Variable]
Student's 3000 Criminals Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`discoveries` [Special Variable]
Yearly Numbers of Important Discoveries

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`dnase` [Special Variable]
Elisa assay of DNase

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`esoph` [Special Variable]
Smoking, Alcohol and (O)esophageal Cancer

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`euro` [Special Variable]
Conversion Rates of Euro Currencies

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`eustockmarkets` [Special Variable]
Daily Closing Prices of Major European Stock Indices, 1991-1998

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`faithful` [Special Variable]
Old Faithful Geyser Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`formaldehyde` [Special Variable]
Determination of Formaldehyde

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`freeny` [Special Variable]
Freeny's Revenue Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`haireyecolor` [Special Variable]
Hair and Eye Color of Statistics Students

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`harman23.cor` [Special Variable]
Harman Example 2.3

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`harman74.cor` [Special Variable]
Harman Example 7.4

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`index` [Special Variable]

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`indometh` [Special Variable]
Pharmacokinetics of Indomethacin

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`infert` [Special Variable]
Infertility after Spontaneous and Induced Abortion

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`insectsprays` [Special Variable]
Effectiveness of Insect Sprays

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`iris` [Special Variable]
Edgar Anderson's Iris Data

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`iris3` [Special Variable]
Edgar Anderson's Iris Data

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`islands` [Special Variable]
Areas of the World's Major Landmasses

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`johnsonjohnson` [Special Variable]
Quarterly Earnings per Johnson & Johnson Share

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`lakehuron` [Special Variable]
Level of Lake Huron 1875-1972

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`lh` [Special Variable]
Luteinizing Hormone in Blood Samples

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`lifecyclesavings` [Special Variable]
Intercountry Life-Cycle Savings Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`loblolly` [Special Variable]
Growth of Loblolly pine trees

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`longley` [Special Variable]
Longley's Economic Regression Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`lynx` [Special Variable]
Annual Canadian Lynx trappings 1821-1934

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`morley` [Special Variable]
Michelson Speed of Light Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`mpg` [Special Variable]
Fuel economy data from 1999 to 2008 for 38 popular models of cars

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`mtcars` [Special Variable]
Motor Trend Car Road Tests

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nhtemp` [Special Variable]
Average Yearly Temperatures in New Haven

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nile` [Special Variable]
Flow of the River Nile

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nottem` [Special Variable]
Average Monthly Temperatures at Nottingham, 1920-1939

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`npk` [Special Variable]
Classical N, P, K Factorial Experiment

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nycflights13-airlines` [Special Variable]
Airline name lookup table by carrier code

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nycflights13-airports` [Special Variable]
Airport metadata

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nycflights13-flights` [Special Variable]
On-time data for all flights that departed NYC (i.e. JFK, LGA or EWR) in 2013

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nycflights13-planes` [Special Variable]
Metadata for all airplane tail numbers found in the FAA aircraft registry

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`nycflights13-weather` [Special Variable]
Hourly meterological data for LGA, JFK and EWR in 2013

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`occupationalstatus` [Special Variable]
Occupational Status of Fathers and their Sons

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`orange` [Special Variable]
Growth of Orange Trees

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`orchardsprays` [Special Variable]
Potency of Orchard Sprays

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`plantgrowth` [Special Variable]
Results from an Experiment on Plant Growth

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`precip` [Special Variable]
Annual Precipitation in US Cities

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`presidents` [Special Variable]
Quarterly Approval Ratings of US Presidents

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`pressure` [Special Variable]
Vapor Pressure of Mercury as a Function of Temperature

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`puromycin` [Special Variable]
Reaction Velocity of an Enzymatic Reaction

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`quakes` [Special Variable]
Locations of Earthquakes off Fiji

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`randu` [Special Variable]
Random Numbers from Congruential Generator RANDU

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`rivers` [Special Variable]
Lengths of Major North American Rivers

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`rock` [Special Variable]
Measurements on Petroleum Rock Samples

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`seatbelts` [Special Variable]
Road Casualties in Great Britain 1969-84

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`stackloss` [Special Variable]
Brownlee's Stack Loss Plant Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`sunspot.month` [Special Variable]
Monthly Sunspot Data, from 1749 to Present

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`sunspot.year` [Special Variable]
Yearly Sunspot Data, 1700-1988

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`sunspots` [Special Variable]
Monthly Sunspot Numbers, 1749-1983

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`swiss` [Special Variable]
Swiss Fertility and Socioeconomic Indicators (1888) Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`theoph` [Special Variable]
Pharmacokinetics of Theophylline

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`titanic` [Special Variable]
Survival of passengers on the Titanic

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`toothgrowth` [Special Variable]
The Effect of Vitamin C on Tooth Growth in Guinea Pigs

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`treering` [Special Variable]
Yearly Treering Data, -6000-1979

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`trees` [Special Variable]
Diameter, Height and Volume for Black Cherry Trees

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`ucbadmissions` [Special Variable]
Student Admissions at UC Berkeley

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`ukdriverdeaths` [Special Variable]
Road Casualties in Great Britain 1969-84

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`ukgas` [Special Variable]
UK Quarterly Gas Consumption

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`usaccdeaths` [Special Variable]
Accidental Deaths in the US 1973-1978

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`usarrests` [Special Variable]
Violent Crime Rates by US State

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`usjudgeratings` [Special Variable]
Lawyers' Ratings of State Judges in the US Superior Court

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`uspersonalexpenditure` [Special Variable]
Personal Expenditure Data

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`uspop` [Special Variable]
Populations Recorded by the US Census

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`vadeaths` [Special Variable]
Death Rates in Virginia (1940)

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`volcano` [Special Variable]
Topographic Information on Auckland's Maunga Whau Volcano

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`warpbreaks` [Special Variable]
The Number of Breaks in Yarn during Weaving

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`women` [Special Variable]
Average Heights and Weights for American Women

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`worldphones` [Special Variable]
The World's Telephones

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`wwwusage` [Special Variable]
Internet Usage per Minute

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

5.1.2 Macros

`def` (*name value* **&optional** *documentation*) [Macro]
Define a data variable
VALUE is not evaluated and must be a symbol. Assigns the value of FORM to VALUE and adds VALUE to the list *VARIABLES* of def'ed variables. Returns VALUE. If VALUE is already bound and the global variable *ASK-ON-REDEFINE* is not nil then you are asked if you want to redefine the variable.

Package [`lisp-stat`], page 13.

Source [`variables.lisp`], page 7.

5.1.3 Ordinary functions

`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 [`lisp-stat`], page 13.

Source [`data.lisp`], page 7.

`fivenum` (*x* **&key** *tukey*) [Function]
By default, returns the five number summary (min, 1st quartile, median, 3rd quartile, max) of the elements X. If the keyword :tukey is set to a non-nil value, Tukey's fivenum summary is computed instead.

Package [`lisp-stat`], page 13.

Source [`stats.lisp`], page 10.

`interquartile-range` (*x*) [Function]
Returns the interquartile range of the elements of X.

Package [lisp-stat], page 13.

Source [stats.lisp], page 10.

`load-r-default-datasets` () [Function]
Load the data sets included in base R

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`load-r-metadata` () [Function]
Loads the master R data set index as a data frame. Use this to query the R data sets.

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`save-r-data` () [Function]

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`save-r-default-datasets` () [Function]
Save the data sets included in base R

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`savevar` (*vars file* **&optional** *suffix*) [Function]
VARS is a symbol or a list of symbols. FILE is a string (or a symbol whose print name is used) not ending in SUFFIX (defaults to ".lisp"). The VARS and their current values are written to the file FILE.lisp in a form suitable for use with the load command. NOTE: Ensure VARS doesn't contain CLOS objects that don't have a SAVE-OBJ method. Example (savevar 'urban "urban")

Package [lisp-stat], page 13.

Source [variables.lisp], page 7.

`undef-var` (*v*) [Function]
Remove V from the system
If V is the symbol of a defined variable the variable it is unbound and removed from the list of defined variables. If V is a list of variable names each is unbound and removed. Returns V. Example: (undef 'urban)

Package [lisp-stat], page 13.

Source [variables.lisp], page 7.

`variables` () [Function]
Returns a list of the names of all def'ed variables.

Package [lisp-stat], page 13.

Source [variables.lisp], page 7.

5.2 Internals

5.2.1 Special variables

`*r-default-dataframes*` [Special Variable]
Data frames corresponding to the default R datasets

Package [`rdata`], page 14.

Source [`rdata.lisp`], page 8.

`*variables*` [Special Variable]

Package [`lisp-stat`], page 13.

Source [`variables.lisp`], page 7.

`iris` [Special Variable]
Edgar Anderson's Iris Data

Description
This famous (Fisher's or Anderson's) iris data set gives the measurements in centimeters of the variables sepal length and width and petal length and width, respectively, for 70 flowers from each of 3 species of iris. The species are Iris setosa, versicolor, and virginica.

Source
Fisher, R. A. (1937) The use of multiple measurements in taxonomic problems. Annals of Eugenics, 7, Part II, 179–188. The data were collected by Anderson, Edgar (1937). The irises of the Gaspe Peninsula, Bulletin of the American Iris Society, 79, 2–7

References
Becker, R. A., Chambers, J. M. and Wilks, A. R. (1988) The New S Language. Wadsworth & Brooks/Cole. (has iris3 as iris.)

Examples (from R)

dni3 <- dimnames(iris3)
ii <- data.frame(matrix(aperm(iris3, c(1,3,2)), ncol = 4,
dimnames = list(NULL, sub(" L.",".Length", sub(" W.",".Width", dni3[[2]])))), Species = gl(3, 50, labels = sub("S", "s", sub("V", "v", dni3[[3]])))) all.equal(ii, iris) # TRUE

Package [`ls-user`], page 13.

`mtcars` [Special Variable]
Motor Trend Car Road Tests

Description
The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973–74 models).

Note
Henderson and Velleman (1981) comment in a footnote to Table 1: 'Hocking [original transcriber]'s noncrucial coding of the Mazda's rotary engine as a straight six-cylinder engine and

the Porsche's flat engine as a V engine, as well as the inclusion of the diesel Mercedes 240D, have been retained to enable direct comparisons to be made with previous analyses.'

Source
Henderson and Velleman (1981), Building multiple regression models interactively. Biometrics, 37, 391–411.

Package [ls-user], page 13.

`plant-growth` [Special Variable]
Results from an Experiment on Plant Growth

Description
Results from an experiment to compare yields (as measured by dried weight of plants) obtained under a control and two different treatment conditions.

Format
A data frame of 30 cases on 2 variables.
[, 1] weight numeric
[, 2] group factor

The levels of group are 'ctrl', 'trt1', and 'trt2'.

Source
Dobson, A. J. (1983) An Introduction to Statistical Modelling. London: Chapman and Hall.

Examples (from R)

One factor ANOVA example from Dobson's book, cf. Table 7.4: require(stats); require(graphics)
boxplot(weight ~ group, data = PlantGrowth, main = "PlantGrowth data", ylab = "Dried weight of plants", col = "lightgray",
notch = TRUE, varwidth = TRUE)
anova(lm(weight ~ group, data = PlantGrowth))

Package [ls-user], page 13.

`student-sleep` [Special Variable]
Student's Sleep Data

Package [rdata], page 14.

Source [rdata.lisp], page 8.

`tooth-growth` [Special Variable]
The Effect of Vitamin C on Tooth Growth in Guinea Pigs

Description
The response is the length of odontoblasts (cells responsible for
tooth growth) in 60 guinea pigs. Each animal received one of three
dose levels of vitamin C (0.5, 1, and 2 mg/day) by one of two delivery methods, orange juice or ascorbic acid (a form of vitamin C and coded as VC).

Format
A data frame with 60 observations on 3 variables.
[,1] len numeric Tooth length
[,2] supp factor Supplement type (VC or OJ).
[,3] dose numeric Dose in milligrams/day

Source
C. I. Bliss (1952). The Statistics of Bioassay. Academic Press.

References
- McNeil, D. R. (1977). Interactive Data Analysis. New York: Wiley.
- Crampton, E. W. (1947). The growth of the odontoblast of the incisor teeth as a criterion of vitamin C intake of the guinea pig. The Journal of Nutrition, 33(5), 491–504. doi: 10.1093/jn/33.5.491.

Examples

require(graphics)
coplot(len ~ dose | supp, data = ToothGrowth, panel = panel.smooth, xlab = "ToothGrowth data: length vs dose, given type of supplement")

Package [ls-user], page 13.

`usarrests` [Special Variable]
Violent Crime Rates by US State

Description
This data set contains statistics, in arrests per 100,000 residents,
for assault, murder, and rape in each of the 50 US states in 1973.
Also given is the percent of the population living in urban areas.

Note
USArrests contains the data as in McNeil's monograph. For the UrbanPop percentages, a review of the table (No. 21) in the Statistical
Abstracts 1975 reveals a transcription error for Maryland (and that
McNeil used the same "round to even" rule that R's round() uses), as
found by Daniel S Coven (Arizona).

See the example below on how to correct the error and improve accuracy
for the '<n>.5' percentages.

Source
World Almanac and Book of facts 1975. (Crime rates).
Statistical Abstracts of the United States 1975, p.20, (Urban rates), possibly available as https://books.google.ch/books?id=zl9qAAAAMAAJ&pg=PA20.

References
McNeil, D. R. (1977) Interactive Data Analysis. New York: Wiley.

Examples

(summary usarrests)

;; Difference between 'USArrests' and its correction
(which usarrests:x3 :predicate (lambda (x) (string= "Maryland" x))) ; #(19) (select usarrests 19 'urbanpop) ; 67, the value transcribed incorrectly (setf (elt usarrests:urbanpop 19) 76.6) ; change to the correct value

;; correct rounding errors of +/- 0.5 to restore the original <n>.5 percentages (map nil (lambda (x)
(setf (elt usarrests:urbanpop x)
(+ 0.5 (elt usarrests:urbanpop x))))
(which usarrests:x3 :predicate (lambda (x)
(or (string= "Colorado" x)
(string= "Florida" x)
(string= "Mississippi" x)
(string= "Wyoming" x)))))

(map nil (lambda (x)
(setf (elt usarrests:urbanpop x)
(- 0.5 (elt usarrests:urbanpop x))))
(which usarrests:x3 :predicate (lambda (x)
(or (string= "Nebraska" x)
(string= "Pennsylvania" x)))))

Package [ls-user], page 13.

5.2.2 Ordinary functions

`setup-ls-translations` () [Function]

Package [lisp-stat], page 13.

Source [ls-init.lisp], page 10.

5.2.3 Generic functions

`save-obj` (*data*) [Generic Function]

Save data object

Package [lisp-stat], page 13.

Source [variables.lisp], page 7.

Appendix A Indexes

A.1 Concepts

(Index is nonexistent)

A.2 Functions

A.3 Variables

*

A

B

C

D

E

F

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

W

A.4 Data types