Package ‘valaddin’

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Title Functional Input Validation

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Description A set of basic tools to transform functions into functions with input validation checks, in a manner suitable for both programmatic and interactive use.

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Description

is_check_formula(x) checks whether x is a check formula, while is_checklist(x) checks whether x is a checklist, i.e., a list of check formulae. (Neither function verifies logical consistency of the implied checks.)

Usage

is_check_formula(x)

is_checklist(x)

Arguments

x Object to test.

Value

is_check_formula, resp. is_checklist, returns TRUE or FALSE, according to whether x is or is not a check formula, resp. checklist.

See Also

firmly (on the specification and use of check formulae)

Examples

is_check_formula(list(~x, ~y) ~ is.numeric) # [1] TRUE
is_check_formula("Not positive" ~ {. > 0}) # [1] TRUE

is_checklist(list(list(~x, ~y) ~ is.numeric, "Not positive" ~ {. > 0}))
# [1] TRUE

# Invalid checklists
is_checklist("Not positive" ~ {. > 0}) # [1] FALSE (not a list)
is_checklist(list(is.numeric ~ list(~ x))) # [1] FALSE (backwards)
is_checklist(list(list(log ~ x) ~ is.character)) # [1] FALSE (invalid check item)
Description

Decompose a firmly applied function (i.e., a function created by firmly):

- **firm_core** extracts the underlying "core" function—the function that is called when all arguments are valid.
- **firm_checks** extracts the checks.
- **firm_error** extracts the subclass of the error condition that is signaled when an input validation error occurs.
- **firm_args** extracts the names of arguments whose presence is to be checked, i.e., those specified by the .warn_missing switch of firmly.

Usage

```r
firm_core(x)
firm_checks(x)
firm_error(x)
firm_args(x)
```

Arguments

- `x` Object to decompose.

Value

If `x` is a firmly applied function:

- **firm_core** returns a function.
- **firm_checks** returns a data frame with components `expr` (language), `env` (environment), `string` (character), `msg` (character).
- **firm_error** returns a character vector.
- **firm_args** returns a character vector.

In the absence of the component to be extracted, these functions return `NULL`.

See Also

- **firmly**
firmly

**Apply a function firmly**

**Description**

`firmly` transforms a function into a function with input validation checks. `loosely` undoes the application of `firmly`, by returning the original function (without checks). `is_firm` is a predicate function that checks whether an object is a firmly applied function, i.e., a function created by `firmly`. Use `%checkin%` to apply `firmly` as an operator. Since this allows you to keep checks and arguments adjacent, it is the preferred way to use `firmly` in scripts and packages.

**Usage**

```r
firmly(.f, ..., .checklist = list(), .warn_missing = character(),
       .error_class = character())

.lochecks %checkin% .f

loosely(.f, .keep_check = FALSE, .keep_warning = FALSE)

is_firm(x)
```

**Arguments**

- `.f` Interpreted function, i.e., closure.
- `...` Input-validation check formula(e).
- `.checklist` List of check formulae. (These are combined with check formulae provided via `...`)
- `.warn_missing` Arguments of `.f` whose absence should raise a warning (character).
- `.error_class` Subclass of the error condition to be raised when an input validation error occurs (character).
- `.checks` List of check formulae, optionally containing character vectors named `.warn_missing`, `.error_class`, corresponding to the similarly named arguments.
Check Formulae

An input validation check is specified by a check formula, a special formula of the form

\[ \text{<scope>} \sim \text{<predicate>} \]

where the right-hand side expresses what to check, and the left-hand side expresses where to check it.

The right-hand side \text{<predicate>} is a predicate function, i.e., a one-argument function that returns either TRUE or FALSE. It is the condition to check/enforce. The left-hand side \text{<scope>} is an expression specifying what the condition is to be applied to: whether the condition is to be applied to all (non-...) arguments of \text{.f} (the case of “global scope”), or whether the condition is to be selectively applied to certain expressions of the arguments (the case of “local scope”).

According to scope, there are two classes of check formulae:

- **Check formulae of global scope**

\[ \text{<string>} \sim \text{<predicate>} \]

- **Check formulae of local scope**

\[ \text{list(<check_item>, <check_item>, ...)} \sim \text{<predicate>} \]

**Check Formulae of Global Scope:** A global check formula is a succinct way of asserting that the function \text{<predicate>} returns TRUE when called on each (non-...) argument of \text{.f}. Each argument for which \text{<predicate>} fails—returns FALSE or is itself not evaluable—produces an error message, which is auto-generated unless a custom error message is supplied by specifying the string \text{<string>}.

**Example:**

The condition that all (non-\text{\dots}) arguments of a function must be numerical can be enforced by the check formula

\[ \{\text{is.numeric} \} \sim \{\text{is.numeric} \} \]

if the custom error message \text{"Not numeric"} is to be used (in lieu of an auto-generated error message).

**Check Formulae of Local Scope:** A local check formula imposes argument-specific conditions. Each check item \text{<check_item>} is a formula of the form \text{~<expression>} (one-sided) or \text{<string> ~ <expression>}; it imposes the condition that the function \text{<predicate>} is TRUE for the expression \text{<expression>}. As for global check formulae, each check item for which \text{<predicate>} fails produces an error message, which is auto-generated unless a custom error message is supplied by a string as part of the left-hand side of the check item (formula).
The condition that \code{x} and \code{y} must differ for the function \code{function(x, y) {1 / (x - y)}} can be enforced by the local check formula

\begin{verbatim}
preformatted{list(~x - y) ~ function(.) abs(.) > 0}
\end{verbatim}

or

\begin{verbatim}
preformatted{list("x, y must differ" ~ x - y) ~ function(.) abs(.) > 0}
\end{verbatim}

if the custom error message \code{"x, y must differ"} is to be used (in lieu of an auto-generated error message).

Anonymous Predicate Functions: Following the \pkg{magrittr} package, an anonymous (predicate) function of a single argument \code{.} can be concisely expressed by enclosing the body of such a function within curly braces \{ \}.

The (on-sided, global) check formula

\begin{verbatim}
preformatted{~(. > 0)}
\end{verbatim}

is equivalent to the check formula \code{~function(.) {. > 0}}

Value

\code{firmly}: \code{firmly} does nothing when there is nothing to do: \code{.f} is returned, unaltered, when both \code{checklist} and \code{warn_missing} are empty, or when \code{.f} has no named argument and \code{warn_missing} is empty.

Otherwise, \code{firmly} again returns a function that behaves \emph{identically} to \code{.f}, but also performs input validation: before a call to \code{.f} is attempted, its inputs are checked, and if any check fails, an error halts further execution with a message tabulating every failing check. (If all checks pass, the call to \code{.f} respects lazy evaluation, as usual.)

Subclass of the input-validation error object

The subclass of the error object is \code{.error_class}, unless \code{.error_class} is \code{character()}. In the latter case, the subclass of the error object is that of the existing error object, if \code{.f} is itself a \code{firmly} applied function, or it is \code{"simpleError"}, otherwise.

Formal Arguments and Attributes

\code{firmly} preserves the attributes and formal arguments of \code{.f} (except that the \code("class") attribute gains the component \code("firm_closure"), unless it already contains it).

%checkin%: \%checkin% applies the check formula(e) in the list \code{.checks} to \code{.f}, using \code{firmly}. The \code{warn_missing} and \code{.error_class} arguments of \code{firmly} may be specified as named components of \code{.checks}. 
loosely: loosely returns .f, unaltered, when .f is not a firmly applied function, or both .keep_check and .keep_warning are TRUE.

Otherwise, \code{loosely} returns the underlying (original) function, stripped of any input validation checks imposed by \code{firmly}, unless one of the flags \code{.keep_check}, \code{.keep_warning} is switched on: if \code{.keep_check}, resp. \code{.keep_warning}, is \code{TRUE}, \code{loosely} retains any existing checks, resp. missing-argument warnings, of \code{.f}.

\begin{itemize}
  \item \texttt{is_firm}: \texttt{is_firm} returns \texttt{TRUE} if \texttt{x} is a firmly applied function (i.e., has class "firm_closure"), and \texttt{FALSE}, otherwise.
\end{itemize}

**See Also**

\texttt{firmly} is enhanced by a number of helper functions:

\begin{itemize}
  \item To verify that a check formula is syntactically correct, use the predicates \texttt{is_check_formula}, \texttt{is_checklist}.
  \item To make custom check-formula generators, use \texttt{localize}.
  \item Pre-made check-formula generators are provided to facilitate argument checks for \texttt{types}, \texttt{scalar objects}, and other common data structures and input assumptions. These functions are pre-fixed by \texttt{vld_}, for convenient browsing and look-up in editors and IDE’s that support name completion.
  \item To access the components of a firmly applied function, use \texttt{firm_core, firm_checks, firm_error, firm_args}, (or simply \texttt{print} the function to display its components).
\end{itemize}

**Examples**

```r
## Not run:

dlog <- function(x, h) (log(x + h) - log(x)) / h

# Require all arguments to be numeric (auto-generated error message)
dlog_fm <- firmly(dlog, ~is.numeric)
dlog_fm(1, .1) # [1] 0.9531018
dlog_fm("1", .1) # Error: "FALSE: is.numeric(x)"

# Require all arguments to be numeric (custom error message)
dlog_fm <- firmly(dlog, "Not numeric" ~ is.numeric)
dlog_fm("1", .1) # Error: "Not numeric: 'x'")

# Alternatively, "globalize" a localized checker (see ?localize, ?globalize)
dlog_fm <- firmly(dlog, globalize(vld_numeric))
dlog_fm("1", .1) # Error: "Not double/integer: 'x'"

# Predicate functions can be specified anonymously or by name
dlog_fm <- firmly(dlog, list(~x, ~x + h, ~abs(h)) ~ function(x) x > 0)
dlog_fm <- firmly(dlog, list(~x, ~x + h, ~abs(h)) ~ (. > 0))
is_positive <- function(x) x > 0
dlog_fm <- firmly(dlog, list(~x, ~x + h, ~abs(h)) ~ is_positive)
```
dlog_fm(1, 0)  # Error: "FALSE: is_positive(abs(h))"

# Describe checks individually using custom error messages
dlog_fm <-
  firmly(dlog,
    list("x not positive" ~ x, ~x + h, "Division by 0 (=h)" ~ abs(h)) ~
      is_positive)
dlog_fm(-1, 0)
# Errors: "x not positive", "FALSE: is_positive(x + h)", "Division by 0 (=h)"

# Specify checks more succinctly by using a (localized) custom checker
req_positive <- localize("Not positive" ~ is_positive)
dlog_fm <- firmly(dlog, req_positive(~x, ~x + h, ~abs(h)))
dlog_fm(1, 0)  # Error: "Not positive: abs(h)"

# Combine multiple checks
dlog_fm <- firmly(dlog,
  "Not numeric" ~ is.numeric,
  list(~x, ~x + h, "Division by 0" ~ abs(h)) ~ {. > 0})
dlog_fm("1", 0)  # Errors: "Not numeric: \"x\"", check-eval error, "Division by 0"

# Any check can be expressed using isTRUE
err_msg <- "x, h differ in length"
dlog_fm <- firmly(dlog, list(err_msg ~ length(x) - length(h)) ~ {. == 0L})
dlog_fm(1:2, 0:2)  # Error: "x, h differ in length"

# More succinctly, use vld_true
dlog_fm <- firmly(dlog, vld_true(~length(x) == length(h), ~all(abs(h) > 0)))
dlog_fm(1:2, 0:2)  # Error: "Not TRUE: length(h)", "Not TRUE: all(abs(h) > 0)"

dlog_fm(1:2, 1:2)  # [1] 0.6931472 0.3465736

# loosely recovers the underlying function
identical(loosely(dlog_fm), dlog)  # [1] TRUE

# Use .warn_missing when you want to ensure an argument is explicitly given
# (see vignette("valaddin") for an elaboration of this particular example)
as_POSIXct <- firmly(as.POSIXct, .warn_missing = "tz")
Sys.setenv(TZ = "EST")
as_POSIXct("2017-01-01 03:14:16")  # [1] "2017-01-01 03:14:16 EST"
  # Warning: "Argument(s) expected ... 'tz'"
as_POSIXct("2017-01-01 03:14:16", tz = "UTC")  # [1] "2017-01-01 03:14:16 UTC"
loosely(as.POSIXct("2017-01-01 03:14:16"))  # [1] "2017-01-01 03:14:16 EST"

# Use firmly to constrain undesirable behavior, e.g., long-running computations
fib <- function(n) {
  if (n <= 1L) return(1L)
  Recall(n - 1) + Recall(n - 2)
}
fib <- firmly(fib, list("\n" capped at 30" ~ ceiling(n)) ~ {. <= 30L})
fib(21)  # [1] 17711 (NB: Validation done only once, not for every recursive call)
fib(31)  # Error: 'n' capped at 30

# Apply fib unrestricted
loosely(fib)(31)  # [1] 2178309 (may take several seconds to finish)

# firmly won't force an argument that's not involved in checks
f <- firmly(function(x, y) "Pass", list(~x ~ is.character)
g(c("a", "b"), stop("Not signaled"))  # [1] "Pass"

# In scripts and packages, it is recommended to use the operator %checkin%
vec_add <- list(
  ~is.numeric,
  list(~length(x) == length(y)) ~ isTRUE,
  .error_class = "inputError"
) %checkin%
function(x, y) {
  x + y
}

# Or call firmly with .f explicitly assigned to the function
vec_add2 <- firmly(
  ~is.numeric,
  list(~length(x) == length(y)) ~ isTRUE,
  .f = function(x, y) {
    x + y
  },
  .error_class = "inputError"
)

all.equal(vec_add, vec_add2)  # [1] TRUE

## End(Not run)

---

input-validators  Generate input-validation checks

Description

localize derives a function that generates check formulae of local scope from a check formula of
global scope. globalize takes such a check-formula generator and returns the underlying global
check formula. These operations are mutually invertible.

Usage

localize(chk)

globalize(chkr)
Arguments

chk  
Check formula of global scope with custom error message, i.e., a formula of the form `<string> ~ <predicate>`.

chkr  
Function of class "check_maker", i.e., a function created by localize.

Value

localize returns a function of class "check_maker" and call signature function(...):

- The ... are check items (see Check Formulae of Local Scope in the documentation page firmly).

- The return value is the check formula of local scope whose scope is comprised of these check items, and whose predicate function is that of chk (i.e., the right-hand side of chk). Unless a check item has its own error message, the error message is derived from that of chk (i.e., the left-hand side of chk).

globalize returns the global-scope check formula from which the function chkr is derived.

See Also

The notion of “scope” is explained in the Check Formulae section of firmly.

Ready-made checkers for types, scalar objects, and miscellaneous predicates are provided as a convenience, and as a model for creating families of check makers.

Examples

```r
chk_pos_gbl <- "Not positive" ~ {. > 0}
chk_pos_lcl <- localize(chk_pos_gbl)
chk_pos_lcl(~x, "y not greater than x" ~ x - y)
# list("Not positive: x" ~ x, "y not greater than x" ~ x - y) ~ {. > 0}

# localize and globalize are mutual inverses
identical(globalize(localize(chk_pos_gbl)), chk_pos_gbl) # [1] TRUE
all.equal(localize(globalize(chk_pos_lcl)), chk_pos_lcl) # [1] TRUE

## Not run:
pass <- function(x, y) "Pass"
# Impose local positivity checks
f <- firmly(pass, chk_pos_lcl(~x, "y not greater than x" ~ x - y))
f(2, 1) # [1] "Pass"
f(2, 2) # Error: "y not greater than x"
f(0, 1) # Errors: "Not positive: x", "y not greater than x"

# Or just check positivity of x
g <- firmly(pass, chk_pos_lcl(~x))
g(1, 0) # [1] "Pass"
g(0, 0) # Error: "Not positive: x"
```
# In contrast, chk_pos_gbl checks positivity for all arguments
h <- firmly(pass, chk_pos_gbl)
h(2, 2) # [1] "Pass"
h(1, 0) # Error: "Not positive: `y`"

h(0, 0) # Errors: "Not positive: `x`", "Not positive: `y`"

# Alternatively, globalize the localized checker
h2 <- firmly(pass, globalize(chk_pos_lcl))
all.equal(h, h2) # [1] TRUE

# Use localize to make parameterized checkers
chk_lte <- function(n, ...) {
  err_msg <- paste("Not \(<=\) ", as.character(n))
  localize(err_msg ~ {. <= n})(...)
}
fib <- function(n) {
  if (n <= 1L) return(1L)
  Recall(n - 1) + Recall(n - 2)
}
capped_fib <- firmly(fib, chk_lte(30, ~ ceiling(n)))
capped_fib(19) # [1] 6765
capped_fib(31) # Error: "Not \(<=\) 30: ceiling(n)"

## End(Not run)

---

misc-checkers  

**Miscellaneous checkers**

### Description

These functions make check formulae of local scope based on the correspondingly named base R predicates `is.*` (e.g., `vld_data_frame` corresponds to the predicate `is.data.frame`), with the following exceptions:

- `vld_empty` is based on the predicate `length(.) == 0`
- `vld_formula` is based on the predicate `typeof(.) == "language" && inherits(., "formula")`
- `vld_closure` is based on the predicate `typeof(.) == "closure"
- `vld_true` and `vld_false` are based on the predicates `identical(., TRUE)` and `identical(., FALSE)`, resp.

The checkers `vld_true` and `vld_false` are all-purpose checkers to specify *arbitrary* input validation checks.

### Usage

```r
vld_all(...)

vld_any(...)
```
vld_array(...)
vld_atomic(...)
vld_call(...)
vld_closure(...)
vld_data_frame(...)
vld_empty(...)
vld_environment(...)
vld_expression(...)
vld_factor(...)
vld_false(...)
vld_formula(...)
vld_function(...)
vld_language(...)
vld_list(...)
vld_matrix(...)
vld_na(...)
vld_name(...)
vld_nan(...)
vld_null(...)
vld_numeric(...)
vld_ordered(...)
vld_pairlist(...)
vld_primitive(...)
vld_recursive(...)
vld_symbol(...)  
vld_table(...)  
vld_true(...)  
vld_unsorted(...)  
vld_vector(...)

Arguments

... Check items, i.e., formulae that are one-sided or have a string as left-hand side (see Check Formulae of Local Scope in the documentation page firmly). These are the expressions to check.

Details

Each function vld_* is a function of class "check_maker", generated by localize.

Value

Check formula of local scope.

See Also

Corresponding predicates: all, any, is.array, is.atomic, is.call, is.data.frame, is.environment, is.expression, is.factor, is.function, is.language, is.list, is.matrix, is.na, is.name, is.nan, is.null, is.numeric, is.ordered, is.pairlist, is.primitive, is.recursive, is.symbol, is.table, is.unsorted, is.vector

globalize recovers the underlying check formula of global scope.

The notions of “scope” and “check item” are explained in the Check Formulae section of firmly.

Other checkers: type-checkers, scalar-checkers

Examples

```r
## Not run:

f <- function(x, y) "Pass"

# Impose the condition that x is a formula
h <- firmly(f, vld_formula(~x))
h(z ~ a + b, 0) # [1] "Pass"
h(0, 0)       # Error: "Not formula: x"

# Impose the condition that x and y are disjoint (assuming they are vectors)
h <- firmly(f, vld_empty(~intersect(x, y)))
h(letters[1:3], letters[4:5]) # [1] "Pass"
h(letters[1:3], letters[3:5]) # Error: "Not empty: intersect(x, y)"
```
# Use a custom error message
h <- firmly(f, vld_empty("x, y must be disjoint" ~ intersect(x, y)))
h(letters[1:3], letters[3:5])  # Error: "x, y must be disjoint"

# vld_true can be used to implement any kind of input validation
ifelse_f <- firmly(ifelse, vld_true(~typeof(yes) == typeof(no)))
(w <- {set.seed(1); rnorm(5)})
  # [1] -0.6264538  0.1836433 -0.8356286  1.5952808  0.3295078
ifelse_f(w > 0, 0, "1")  # Error: "Not TRUE: typeof(yes) == typeof(no)"
ifelse_f(w > 0, 0, 1)    # [1] 1 0 1 0 0

## End(Not run)

---

### Description

These functions make check formulae of local scope based on the correspondingly named scalar type predicate from base R. For example, vld_scalar_logical creates check formulae (of local scope) for the predicate is.logical(.) && length(.) == 1. The function vld_singleton is based on the predicate length(.) == 1.

The functions vld_boolean, vld_number, vld_string are aliases for vld_scalar_logical, vld_scalar_numeric, vld_scalar_character, resp. (with appropriately modified error messages).

### Usage

vld_boolean(...)

vld_number(...)

vld_scalar_atomic(...)  
vld_scalar_character(...)  
vld_scalar_complex(...)  
vld_scalar_double(...)  
vld_scalar_integer(...)  
vld_scalar_list(...)  
vld_scalar_logical(...)  
vld_scalar_numeric(...)
vld_scalar_raw(...)

vld_scalar_vector(...)

vld_singleton(...)

vld_string(...)

Arguments

Check items, i.e., formulae that are one-sided or have a string as left-hand side (see Check Formulae of Local Scope in the documentation page firmly). These are the expressions to check.

Details

Each function vld_* is a function of class "check_maker", generated by localize.

Value

Check formula of local scope.

See Also

Corresponding predicates: is.atomic, is.character, is.complex, is.double, is.integer, is.list, is.logical, is.numeric, is.raw, is.vector globalize recovers the underlying check formula of global scope.

The notions of “scope” and “check item” are explained in the Check Formulae section of firmly.

Other checkers: type-checkers, misc-checkers

Examples

## Not run:

f <- function(x, y) "Pass"

# Impose a check on x: ensure it's boolean (i.e., a scalar logical vector)
f_firm <- firmly(f, vld_boolean(~x))
f_firm(TRUE, 0) # [1] "Pass"
f_firm(c(TRUE, TRUE), 0) # Error: "Not boolean: x"

# Use a custom error message
f_firm <- firmly(f, vld_boolean("x is not TRUE/FALSE/NA" ~ x))
f_firm(c(TRUE, TRUE), 0) # Error: "x is not TRUE/FALSE/NA"

# To impose the same check on all arguments, apply globalize
f_firmer <- firmly(f, globalize(vld_boolean))
f_firmer(TRUE, FALSE) # [1] "Pass"
f_firmer(TRUE, 0) # Error: "Not boolean: `y``
## Type Checkers

These functions make check formulae of local scope based on the correspondingly named (atomic) type predicate from base R.

### Usage

```r
vld_character(...) 
vld_complex(...) 
vld_double(...) 
vld_integer(...) 
vld_logical(...) 
vld_raw(...) 
```

### Arguments

... Check items, i.e., formulae that are one-sided or have a string as left-hand side (see Check Formulae of Local Scope in the documentation page firmly). These are the expressions to check.

### Details

Each function vld_* is a function of class "check_maker", generated by localize.

### Value

Check formula of local scope.

### See Also

Corresponding predicates: `is.character`, `is.complex`, `is.double`, `is.integer`, `is.logical`, `is.raw`

globalize recovers the underlying check formula of global scope.

The notions of "scope" and "check item" are explained in the Check Formulae section of firmly.

Other checkers: `scalar-checkers`, `misc-checkers`
validate

Examples

## Not run:

f <- function(x, y) "Pass"

# Impose a check on x: ensure it's of type "logical"
f_firm <- firmly(f, vld_logical(~x))
f_firm(TRUE, 0) # [1] "Pass"
f_firm(1, 0)    # Error: "Not logical: x"

# Use a custom error message
f_firm <- firmly(f, vld_logical("x should be a logical vector" ~ x))
f_firm(TRUE, 0)    # Error: "x should be a logical vector"

# To impose the same check on all arguments, apply globalize()
f_firmer <- firmly(f, globalize(vld_logical))
f_firmer(TRUE, FALSE) # [1] "Pass"
f_firmer(TRUE, 0)     # Error: "Not logical: ‘y’"
f_firmer(1, 0)        # Errors: "Not logical: ‘x’", "Not logical: ‘y’"

## End(Not run)

---

validate Validate objects

Description

Validate objects

Usage

validate(.f %checkout% .checks)

Arguments

.f Object to validate.

... Input-validation check formula(e).

.checklist List of check formulae. (These are combined with check formulae provided via ...

.error_class Subclass of the error condition to be raised when an input validation error occurs (character).

.f Interpreted function, i.e., closure.

.checks List of check formulae, optionally containing a character vector named .error_class, corresponding to the similarly named argument.
Examples

```r
## Not run:
library(magrittr)

# Valid assertions: data frame returned (invisibly)
mtcars %>%
  validate(
    vld_all(~sapply(., is.numeric)),
    ~(nrow(.) > 10),
    vld_all(~c("mpg", "cyl") %in% names(.))
  )

# Invalid assertions: error raised
mtcars %>%
  validate(
    vld_all(~sapply(., is.numeric)),
    ~(nrow(.) > 1000),
    vld_all(~c("mpg", "cylinders") %in% names(.))
  )

## End(Not run)
```
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