

# Package ‘DIZtools’

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**Title** Lightweight Utilities for 'DIZ' R Package Development

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**Description** Lightweight utility functions used for the R package development infrastructure inside the data integration centers ('DIZ') to standardize and facilitate repetitive tasks such as setting up a database connection or issuing notification messages and to avoid redundancy.

**License** GPL-3

**URL** <https://github.com/miracum/misc-diztools>

**BugReports** <https://github.com/miracum/misc-diztools/issues>

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|                 |                                                                           |
|-----------------|---------------------------------------------------------------------------|
| assign_to_R_env | <i>Add variable to R environment (in contrast to system environment).</i> |
|-----------------|---------------------------------------------------------------------------|

---

## Description

Hack variable into global env (bypasses R CMD checks). This does create a new variable in the R environment but NOT a new variable in the system environment. To create a system environment variable being accessible via 'Sys.getenv(...)', use the function 'DIZtools::setenv2(key = "varname", val = 7)'. Old function name: 'global\_env\_hack()'

## Usage

```
assign_to_R_env(key, val, pos = 1)
```

## Arguments

|     |                                                           |
|-----|-----------------------------------------------------------|
| key | A character (!) string. The name of the assigned variable |
| val | An object. The object that will be assigned to 'key'.     |
| pos | An integer. The position of the environment (default: 1). |

## Value

No return value, called for side effects (see description).

## See Also

<http://adv-r.had.co.nz/Environments.html>

## Examples

```
utils_path <- tempdir()
assign_to_R_env(
  key = "utils_path",
  val = utils_path,
  pos = 1L
)
```

---

`calculate_check_digit` *Calculate Check Digit Using DIN/ISO 7064, Mod 11,10*

---

**Description**

This function calculates the check digit for a given ID based on the DIN ISO 7064, Mod 11,10 algorithm.

**Usage**

```
calculate_check_digit(patid)
```

**Arguments**

|                    |                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------|
| <code>patid</code> | A numeric or character string representing the ID. It should be either 9 or 10 digits long. |
|--------------------|---------------------------------------------------------------------------------------------|

**Details**

The function processes the input 'patid' as follows: - If the input has 10 digits and does not start with '0', it is assumed to be a patient ID with a check digit. The check digit is removed. - If the input has 9 digits, a leading '0' is added. - If the input has 10 digits and starts with '0', it is already in the expected format. - If the input does not match these cases, an error message is returned.

The check digit is calculated using the ISO 7064, Mod 11,10 method.

**Value**

An integer representing the computed check digit (0-9). Returns 'NA' if the input is invalid.

**Examples**

```
calculate_check_digit("100000138") # Returns check digit (1) for this ID
calculate_check_digit(123456789)   # Works with numeric input as well (6)
```

---

`check_if_unique_rows` *Takes a data.table dataset and checks if for each unique element in a specified column there is exactly one row.*

---

**Description**

Takes a data.table dataset and checks if for each unique element in a specified column there is exactly one row.

**Usage**

```

check_if_unique_rows(
    data,
    colname,
    findme = NULL,
    stop = FALSE,
    feedback = TRUE,
    print_invalid_rows = TRUE,
    return = TRUE
)

```

**Arguments**

|                    |                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| data               | A data.table                                                                                                                                                                                                                                                                          |
| colname            | The name of the column to check for uniqueness.                                                                                                                                                                                                                                       |
| findme             | (Optional, String, default: "") Recommended with length 10. String to find the message in the code. E.g. 10-digit random hex from <a href="https://onlinetools.com/random/generate-random-hexadecimal-numbers">https://onlinetools.com/random/generate-random-hexadecimal-numbers</a> |
| stop               | (boolean, default = FALSE) Should the function call stop() if there are non-unique rows in the data?                                                                                                                                                                                  |
| feedback           | (boolean, default = TRUE) Should the function print text to the console depending on the result?                                                                                                                                                                                      |
| print_invalid_rows | (boolean, default = TRUE) Should the function print invalid rows to the console?                                                                                                                                                                                                      |
| return             | (boolean, default = TRUE) Should the function return 'TRUE' or 'FALSE' depending on the result? If 'stop = TRUE' is set, the function will end with 'stop()' before returning anything.                                                                                               |

**Examples**

```

## Not run:
  check_if_unique_rows(data)

## End(Not run)

```

---

|                     |                                                                  |
|---------------------|------------------------------------------------------------------|
| cleanup_old_logfile | <i>Archives the current logfile and creates a new blank one.</i> |
|---------------------|------------------------------------------------------------------|

---

**Description**

This function is called once at the beginning of the runtime of the tool. It checks whether there is an old logfile and renames it (if existing) to "logfile\_20yy-mm-dd-HHMMSS.log". Then a new, empty, logfile "logfile.log" is created.

**Usage**

```
cleanup_old_logfile(logfile_dir)
```

**Arguments**

logfile\_dir      (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.

**Value**

No return value, called for side effects (see description)

**Examples**

```
cleanup_old_logfile("path/to/logfile/dir/")
```

---

|                 |                                                           |
|-----------------|-----------------------------------------------------------|
| clean_path_name | <i>Clean paths to surely have a tailing slash or not.</i> |
|-----------------|-----------------------------------------------------------|

---

**Description**

Function to clean paths to surely have a tailing slash or not.

**Usage**

```
clean_path_name(pathname, remove.slash = FALSE)
```

**Arguments**

pathname          A character string. A path name to be cleaned (to have a tailing slash or not).  
 remove.slash      (boolean) Default: FALSE. Should the result contain the tailing slash or remove it?

**Value**

The result is the input but with an tailing slash.

**Examples**

```
# Both function calls will return "home/test/"
clean_path_name("home/test")
clean_path_name("home/test/")
```

---

|       |                                                     |
|-------|-----------------------------------------------------|
| clear | <i>Clean the console and environment-variables.</i> |
|-------|-----------------------------------------------------|

---

**Description**

Function to clean the local environment. The call of this function clears the console and the local environment variables.

**Usage**

```
clear(keep_environment = FALSE, keep_console = FALSE)
```

**Arguments**

`keep_environment` (Optional, boolean) If true, the objects from the environment will not be deleted/emptied.

`keep_console` (Optional, boolean) If true, the console will not be emptied.

**Value**

Nothing.

**Examples**

```
clear()
```

---

|                       |                                          |
|-----------------------|------------------------------------------|
| close_all_connections | <i>Unset/close all open connections.</i> |
|-----------------------|------------------------------------------|

---

**Description**

This function is meant to be called at the end of a run of the app. It will close all open connections to files or databases. This closes ALL connections. Not just the ones opened by this package.

**Usage**

```
close_all_connections()
```

**Value**

No return value, called for side effects (see description)

**Examples**

```
close_all_connections()
```

---

|                  |                                                                   |
|------------------|-------------------------------------------------------------------|
| dt_row_to_string | <i>Get the content of a data.table row in print-ready format.</i> |
|------------------|-------------------------------------------------------------------|

---

### Description

Create string of the content of a data.table row in print-ready format.

### Usage

```
dt_row_to_string(dt, row = 1, sep = ", ", collapse = ": ", quote = "'')
```

### Arguments

|          |                                                                                                                                                                                              |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| dt       | (data.table) The input data.table.                                                                                                                                                           |
| row      | (int, Optional) Row id to be used. Defaults to 1.                                                                                                                                            |
| sep      | a character string to separate the terms. Not <a href="#">NA_character_</a> .                                                                                                                |
| collapse | an optional character string to separate the results. Not <a href="#">NA_character_</a> . When collapse is a string, the result is always a string ( <a href="#">character</a> of length 1). |
| quote    | (character, Optional) A quote parameter to be applied to all values of the rows.                                                                                                             |

### Value

A character string. To print the result, simply forward it to print: `dt |> dt_row_to_string()`

### Examples

```
data.table::data.table(name = "Alice",
  dob = as.POSIXct("1980-01-01"),
  sex = "f") |>
  DIZtools::dt_row_to_string()
```

---

|         |                                                                                                                       |
|---------|-----------------------------------------------------------------------------------------------------------------------|
| equals2 | <i>Robust compare two elements and return true if both elements are the same. False otherwise. No 'NA' or 'NULL'.</i> |
|---------|-----------------------------------------------------------------------------------------------------------------------|

---

### Description

The base-R function `'=='` is not working in an intended way for NAs and boolean. This function fixes this.

### Usage

```
equals2(v1, v2)
```

**Arguments**

|    |                          |
|----|--------------------------|
| v1 | First vector or element  |
| v2 | Second vector or element |

**Value**

The equality between both vectors.

**References**

[http://www.cookbook-r.com/Manipulating\\_data/Comparing\\_vectors\\_or\\_factors\\_with\\_NA/](http://www.cookbook-r.com/Manipulating_data/Comparing_vectors_or_factors_with_NA/)>

**Examples**

```
## Not run:
dt <-
  data.table::data.table(
    a = c(TRUE, TRUE, TRUE, FALSE, FALSE, FALSE, NA, NA, NA),
    b = c(TRUE, FALSE, NA, TRUE, FALSE, NA, TRUE, FALSE, NA)
  )
dt[, "classic_result" := get("a") == get("b")]
dt[, "result_expected" := equals2(get("a"), get("b"))]
dt
## This is the result:
#       a      b classic_result result_expected
# 1: TRUE  TRUE          TRUE          TRUE
# 2: TRUE FALSE          FALSE          FALSE
# 3: TRUE  NA             NA          FALSE
# 4: FALSE TRUE          FALSE          FALSE
# 5: FALSE FALSE          TRUE          TRUE
# 6: FALSE  NA             NA          FALSE
# 7:  NA  TRUE             NA          FALSE
# 8:  NA FALSE             NA          FALSE
# 9:  NA  NA              NA          TRUE

## End(Not run)
```

---

 feedback

*Function to feedback messages either to the user and/or to the console and to the logfile.*

---

**Description**

This function provides the functionality to publish any kind of information to the user, the console and/or to the logfile. This might be a simple info, a warning or an error. The function can be used to select the output (console, ui, logfile). If no output is selected, the `print_this` string will be printed to the console and to logfile. One of these must be a string with length > 0: `print_me`, `console`, `ui`.

Default parameters can be set using the function 'DIZtools::log\_set\_defaults'. This function uses 'logger' as package to log to the console. If you are new to this function, consider using 'logger' instead.

### Usage

```
feedback(
  print_this = NULL,
  type = NULL,
  ui = NULL,
  console = NULL,
  logfile = NULL,
  logjs = NULL,
  prefix = NULL,
  suffix = NULL,
  findme = NULL,
  logfile_dir = NULL,
  headless = NULL
)
```

### Arguments

|             |                                                                                                                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this  | (Optional, String, default: "")                                                                                                                                                                                                                                                       |
| type        | (Optional, String, default: "Info") E.g. "Warning", "Error". Default: "Info"                                                                                                                                                                                                          |
| ui          | (Optional, Boolean/String, default: FALSE) If true, the message will also be printed to the user in form of a modal. Can also be a string.                                                                                                                                            |
| console     | (Optional, Boolean/String, default: TRUE) If true, the message will also be printed to the console as is. Can also be a string.                                                                                                                                                       |
| logfile     | (Optional, Boolean, default: TRUE) If true (default) the print_this string will also be printed to the console.                                                                                                                                                                       |
| logjs       | (Optional, Boolean, default: FALSE) If true (default: false) the print_this string will also be printed to the javascript-console. This only makes sense, if the gui is active.                                                                                                       |
| prefix      | Prefix (Optional, String, default: "") This is useful if print_this is an array/list. Each entry will then be new row with this prefix.                                                                                                                                               |
| suffix      | Suffix (Optional, String, default: "") Same like prefix but at the end of each line.                                                                                                                                                                                                  |
| findme      | (Optional, String, default: "") Recommended with length 10. String to find the message in the code. E.g. 10-digit random hex from <a href="https://onlinetools.com/random/generate-random-hexadecimal-numbers">https://onlinetools.com/random/generate-random-hexadecimal-numbers</a> |
| logfile_dir | (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.                                                                                                                                                                                |
| headless    | (Optional, Boolean, default: TRUE) Indicating, if the function is run only in the console (headless = TRUE) or on a GUI frontend (headless = FALSE).                                                                                                                                  |

### Value

No return value, called for publishing a message.

**See Also**

<https://daroczig.github.io/logger/>

**Examples**

```
feedback(  
    print_this = "This is an error message you can provide",  
    type = "Error",  
    findme = "215bb3695c",  
    logfile_dir = tempdir(),  
    headless = TRUE  
)
```

---

feedback\_get\_formatted\_string  
*Format the feedback string*

---

**Description**

Helper function for the feedback function to combine the input parameters in proper manner to be a pretty and informative string which than can be added to the logfile and/or be displayed in the console. CAUTION: 'print\_this' must be of length 1! For arrays loop through them by hand and call this function several times! Internal use. Use the robust 'feedback' function instead.

**Usage**

```
feedback_get_formatted_string(print_this, type, findme, prefix, suffix)
```

**Arguments**

|            |                                                                                                                                                                                                                                                                                       |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this | (Optional, String, default: "")                                                                                                                                                                                                                                                       |
| type       | (Optional, String, default: "Info") E.g. "Warning", "Error". Default: "Info"                                                                                                                                                                                                          |
| findme     | (Optional, String, default: "") Recommended with length 10. String to find the message in the code. E.g. 10-digit random hex from <a href="https://onlinetools.com/random/generate-random-hexadecimal-numbers">https://onlinetools.com/random/generate-random-hexadecimal-numbers</a> |
| prefix     | Prefix (Optional, String, default: "") This is useful if print_this is an array/list. Each entry will then be new row with this prefix.                                                                                                                                               |
| suffix     | Suffix (Optional, String, default: "") Same like prefix but at the end of each line.                                                                                                                                                                                                  |

**Value**

Returns a properly an consistent formatted string containing the parameters handed over to this function.

---

feedback\_to\_console     *Print to the console. Internal use only.*

---

## Description

Helper function for the feedback function to print stuff to the console. Everything will also be added to the logfile. Internal use. Use the robust 'feedback' function instead.

## Usage

```
feedback_to_console(
    print_this,
    type,
    findme,
    prefix,
    suffix,
    logjs,
    logfile_dir,
    headless = TRUE
)
```

## Arguments

|             |                                                                                                                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this  | (Optional, String, default: "")                                                                                                                                                                                                                                                       |
| type        | (Optional, String, default: "Info") E.g. "Warning", "Error". Default: "Info"                                                                                                                                                                                                          |
| findme      | (Optional, String, default: "") Recommended with length 10. String to find the message in the code. E.g. 10-digit random hex from <a href="https://onlinetools.com/random/generate-random-hexadecimal-numbers">https://onlinetools.com/random/generate-random-hexadecimal-numbers</a> |
| prefix      | Prefix (Optional, String, default: "") This is useful if print_this is an array/list. Each entry will then be new row with this prefix.                                                                                                                                               |
| suffix      | Suffix (Optional, String, default: "") Same like prefix but at the end of each line.                                                                                                                                                                                                  |
| logjs       | (Optional, Boolean, default: FALSE) If true (default: false) the print_this string will also be printed to the javascript-console. This only makes sense, if the gui is active.                                                                                                       |
| logfile_dir | (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.                                                                                                                                                                                |
| headless    | (Optional, Boolean, default: TRUE) Indicating, if the function is run only in the console (headless = TRUE) or on a GUI frontend (headless = FALSE).                                                                                                                                  |

## Value

No return value, called for side effects (see description)

---

feedback\_to\_logfile     *Add to the logfile. Internal use.*

---

### Description

Helper function for the feedback function to add content to the logfile. Internal use. Use the robust 'feedback' function instead.

### Usage

```
feedback_to_logfile(print_this, type, findme, prefix, suffix, logfile_dir)
```

### Arguments

|             |                                                                                                                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this  | (Optional, String, default: "")                                                                                                                                                                                                                                                       |
| type        | (Optional, String, default: "Info") E.g. "Warning", "Error". Default: "Info"                                                                                                                                                                                                          |
| findme      | (Optional, String, default: "") Recommended with length 10. String to find the message in the code. E.g. 10-digit random hex from <a href="https://onlinetools.com/random/generate-random-hexadecimal-numbers">https://onlinetools.com/random/generate-random-hexadecimal-numbers</a> |
| prefix      | Prefix (Optional, String, default: "") This is useful if print_this is an array/list. Each entry will then be new row with this prefix.                                                                                                                                               |
| suffix      | Suffix (Optional, String, default: "") Same like prefix but at the end of each line.                                                                                                                                                                                                  |
| logfile_dir | (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.                                                                                                                                                                                |

### Value

No return value, called for side effects (see description)

---

feedback\_to\_logjs     *Feedback to the gui/browser-console with logjs. Internal use.*

---

### Description

Helper function for the feedback function to also show the messages to the gui/user via the browser console. Internal use. Use the robust 'feedback' function instead.

### Usage

```
feedback_to_logjs(print_this, logfile_dir, headless)
```

**Arguments**

|             |                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this  | (Optional, String, default: "")                                                                                                                      |
| logfile_dir | (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.                                               |
| headless    | (Optional, Boolean, default: TRUE) Indicating, if the function is run only in the console (headless = TRUE) or on a GUI frontend (headless = FALSE). |

**Value**

No return value, called for side effects (see description)

---

|                |                                                         |
|----------------|---------------------------------------------------------|
| feedback_to_ui | <i>Feedback to the user with a modal. Internal use.</i> |
|----------------|---------------------------------------------------------|

---

**Description**

Helper function for the feedback function to show modals to the gui/user. Everything will also be added to the logfile. Internal use. Use the robust 'feedback' function instead.

**Usage**

```
feedback_to_ui(print_this, type, logfile_dir, headless = FALSE)
```

**Arguments**

|             |                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this  | (Optional, String, default: "")                                                                                                                      |
| type        | (Optional, String, default: "Info") E.g. "Warning", "Error". Default: "Info"                                                                         |
| logfile_dir | (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.                                               |
| headless    | (Optional, Boolean, default: TRUE) Indicating, if the function is run only in the console (headless = TRUE) or on a GUI frontend (headless = FALSE). |

**Value**

No return value, called for side effects (see description)

---

|                    |                                                          |
|--------------------|----------------------------------------------------------|
| file_lines_to_list | <i>Read in lines from a file and store it in a list.</i> |
|--------------------|----------------------------------------------------------|

---

**Description**

Read in lines from a file and store it in a list.

**Usage**

```
file_lines_to_list(filepath)
```

**Arguments**

filepath            (string) Path to file to read in.

**Value**

A list with one element per row of the input file

---

|         |                                                                    |
|---------|--------------------------------------------------------------------|
| firstup | <i>Converts the first letter of the input string to uppercase.</i> |
|---------|--------------------------------------------------------------------|

---

**Description**

Converts the first letter of the input string to uppercase.

**Usage**

```
firstup(x)
```

**Arguments**

x                    A character string. E.g. "hello world" will become "Hello world".

**Value**

Returns the input string but with a capital first letter.

**Examples**

```
{
firstup("first letter of this string will be upper case as return")
}
```

---

|                |                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------|
| format_posixct | <i>Formats a given POSIXct timestamp without the need of manually specifying format parameters.</i> |
|----------------|-----------------------------------------------------------------------------------------------------|

---

## Description

See title.

## Usage

```
format_posixct(x, lang = "en", date = TRUE, time = TRUE)
```

## Arguments

|      |                                                                                                                                                                                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x    | The POSIXct timestamp or a string to be automatically converted to a POSIXct timestamp.                                                                                                      |
| lang | (Optional, String, Default = "en") The language of the result. Currently implemented: "en"/"de". If you supply another not yet implemented language here, "en" will be chosen automatically. |
| date | (Optional, Boolean, Default = TRUE) Should the date be part of the result string?                                                                                                            |
| time | (Optional, Boolean, Default = TRUE) Should the time be part of the result string?                                                                                                            |

## Value

(String) The formatted timestamp as a string.

## Examples

```
## Not run:
format_POSIXct(x = "2021-12-31 12:34")
## Result: "2021-12-31, 12:34:00"
format_POSIXct(x = "2021-12-31 12:34", lang = "de")
## Result: "31.12.2021, 12:34:00"
format_posixct(Sys.time())
## Result: "2022-01-01, 09:10:50"
)
## End(Not run)
```

---

|            |                                                                       |
|------------|-----------------------------------------------------------------------|
| get_config | <i>Reads a config yaml file and return the value for a given key.</i> |
|------------|-----------------------------------------------------------------------|

---

**Description**

Reads a config yaml file and return the value for a given key.

**Usage**

```
get_config(config_file, config_key)
```

**Arguments**

|             |                                                                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| config_file | A character string. The path to the config.yaml-file containing the database configuration.                                                            |
| config_key  | A character string. The name of the corresponding database. This string must be conform with the corresponding config section in the config.yaml-file. |

**Value**

If successful it returns the value, Null otherwise.

**Examples**

```
utils_path <- tempdir()
config <- get_config(
  config_file = paste0(utils_path, "/MISC/email.yaml"),
  config_key = "email"
)
```

---

|                       |                                                                                          |
|-----------------------|------------------------------------------------------------------------------------------|
| get_current_timestamp | <i>Quickly get the current time stamp without the need to handle format-options etc.</i> |
|-----------------------|------------------------------------------------------------------------------------------|

---

**Description**

Function to quickly get the current time stamp without need to handle format-options etc.

**Usage**

```
get_current_timestamp(no_spaces = FALSE)
```

**Arguments**

`no_spaces` Boolean. Default = 'FALSE'. Specifies whether the output can contain spaces or not. E.g. if the output is for human reading, 'no\_spaces = FALSE' is a good option. As suffix for file names (e.g. logfiles), 'no\_spaces = TRUE' might be a good option.

**Value**

The current timestamp in always the same format. #'

**Examples**

```
get_current_timestamp(no_spaces = TRUE)
# Result: "2020-12-03-134354"
get_current_timestamp()
# this is the same like
get_current_timestamp(no_spaces = FALSE)
# Result: "03.12.2020 - 13:43 UTC"
```

---

|                   |                                                 |
|-------------------|-------------------------------------------------|
| get_package_names | <i>Get used package names from R/qmd-files.</i> |
|-------------------|-------------------------------------------------|

---

**Description**

E.g. for publication purposes it might be useful to quickly get all used package names out of a bunch of used scripts. This function takes the path to all the scripts and extracts the used package names if they are used in the manner "packagename::function()".

**Usage**

```
get_package_names(
  paths = c("."),
  file_endings = c("R", ".qmd"),
  pretty = TRUE,
  include_package_versions = TRUE
)
```

**Arguments**

`paths` A character vector with the paths to all files to be searched. Default: "." (so the current directory).

`file_endings` A character vector containing the file types to search through. Default: "R" and "qmd". Case-sensitive!

`pretty` Logical. If 'TRUE' (default), the result will be a single string containing all packages combined in one single string. If 'FALSE', the result will be a vector, containing all packages so one can apply the pretty formatting on his/her own.

```
include_package_versions
```

Logical. If 'TRUE' (default), the result will contain also the currently installed version of the package. If the package is not installed, the version will be needed to be fixed manually (output will be "tbd").

## Value

A vector of all found package names.

## Examples

```
## Not run:
paths <- c("~", "/path/to/project/R")
get_package_names(
  paths = paths
)

## End(Not run)
```

---

is.empty

---

*Check for empty/'NA'/'NULL'/'NaN'/etc. values.*


---

## Description

Rails-inspired helper that checks if vector values are "empty", i.e. if it's: NULL, zero-length, NA, NaN, FALSE, an empty string or  $\emptyset$ . Note that unlike its native R `is.<something>` sibling functions, `is.empty` is vectorised (hence the "values").

## Usage

```
is.empty(x, trim = TRUE, all = FALSE, ...)
```

## Arguments

|      |                                                                                                                                                                  |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| x    | an object to check its emptiness                                                                                                                                 |
| trim | trim whitespace? (TRUE by default)                                                                                                                               |
| all  | return overall result over list/vector instead of vector of results? <code>is.empty(x, all = TRUE)</code> is the same like <code>all(unlist(is.empty(x)))</code> |
| ...  | additional arguments for <a href="#">sapply</a>                                                                                                                  |

## Source

Copied from 'rapportools::is.empty()'

Examples

```
## Not run:
is.empty(NULL)      # [1] TRUE
is.empty(c())       # [1] TRUE
is.empty(NA)        # [1] TRUE
is.empty(NaN)       # [1] TRUE
is.empty("")        # [1] TRUE
is.empty(0)         # [1] TRUE
is.empty(0.00)      # [1] TRUE
is.empty("  ")      # [1] TRUE
is.empty("foobar")  # [1] FALSE
is.empty("  ", trim = FALSE) # [1] FALSE
## is.empty is vectorised!
all(is.empty(rep("", 10))) # [1] TRUE
all(is.empty(matrix(NA, 10, 10))) # [1] TRUE
is.empty(matrix(NA, 10, 10), all = TRUE)) # [1] TRUE

## End(Not run)
```

---

|                |                                                        |
|----------------|--------------------------------------------------------|
| is_date_format | <i>Checks if a string matches a given date format.</i> |
|----------------|--------------------------------------------------------|

---

Description

Checks if a string matches a given date format.

Usage

```
is_date_format(date, format)
```

Arguments

- date                   The list applied from rv\$restricting\_date
- format                The format parameters. See ?strptime for parameter info.

Value

TRUE/FALSE

---

`log_get_current_options`*Get the current settings for the logging function as list.*

---

**Description**

Get the current settings for the logging function as list

**Usage**

```
log_get_current_options()
```

**Value**

The list with the current parameters.

**Examples**

```
log_get_current_options()
```

---

`log_get_default_options`*Get the default settings for the logging function as list.*

---

**Description**

Get the default settings for the logging function as list

**Usage**

```
log_get_default_options()
```

**Value**

The list with the default parameters.

**Examples**

```
log_get_default_options()
```

---

|                   |                                              |
|-------------------|----------------------------------------------|
| log_internal_test | <i>Internal function for debugging only.</i> |
|-------------------|----------------------------------------------|

---

**Description**

Internal function for debugging only.

**Usage**

```
log_internal_test()
```

**Value**

Nothing.

---

|                            |                                                                                             |
|----------------------------|---------------------------------------------------------------------------------------------|
| log_map_type_to_loggertype | <i>Get the logger type from the type string (the argument of the 'feedback()' function)</i> |
|----------------------------|---------------------------------------------------------------------------------------------|

---

**Description**

Mapping the log-types from string to logger::`<type>`. E.g. the string "Info" will be mapped to 'logger::INFO'.

**Usage**

```
log_map_type_to_loggertype(type)
```

**Arguments**

|      |                                                         |
|------|---------------------------------------------------------|
| type | (String) The type of the message. E.g. "error", "Info". |
|------|---------------------------------------------------------|

**Value**

The 'logger' type. If no corresponding logger-type is found, the result will be 'NULL'.

---

|                    |                                                         |
|--------------------|---------------------------------------------------------|
| log_remove_options | <i>Remove all log-related options from 'options()'.</i> |
|--------------------|---------------------------------------------------------|

---

**Description**

Remove all log-related options from 'options()'.

**Usage**

```
log_remove_options()
```

**Value**

Nothing.

**Examples**

```
log_remove_options()
```

---

|                  |                                                  |
|------------------|--------------------------------------------------|
| log_set_defaults | <i>Set default options for all log-functions</i> |
|------------------|--------------------------------------------------|

---

**Description**

This function sets the default log options. Parameters not supplied to this function will be set with the default value. If you want to reset all parameters to the default ones, run `log_set_defaults(reset = TRUE)`. This can also be combined with a new custom default value: `log_set_defaults(reset = TRUE, prefix = "Prefix")` which will reset all parameters to default and afterwards assign "Prefix" as new global prefix.

**Usage**

```
log_set_defaults(  
  print_this = NULL,  
  type = NULL,  
  ui = NULL,  
  console = NULL,  
  logfile = NULL,  
  logjs = NULL,  
  prefix = NULL,  
  suffix = NULL,  
  findme = NULL,  
  logfile_dir = NULL,  
  headless = NULL,  
  reset = FALSE  
)
```

**Arguments**

|             |                                                                                                                                                                                                                                                                                       |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| print_this  | (Optional, String, default: "")                                                                                                                                                                                                                                                       |
| type        | (Optional, String, default: "Info") E.g. "Warning", "Error". Default: "Info"                                                                                                                                                                                                          |
| ui          | (Optional, Boolean/String, default: FALSE) If true, the message will also be printed to the user in form of a modal. Can also be a string.                                                                                                                                            |
| console     | (Optional, Boolean/String, default: TRUE) If true, the message will also be printed to the console as is. Can also be a string.                                                                                                                                                       |
| logfile     | (Optional, Boolean, default: TRUE) If true (default) the print_this string will also be printed to the console.                                                                                                                                                                       |
| logjs       | (Optional, Boolean, default: FALSE) If true (default: false) the print_this string will also be printed to the javascript-console. This only makes sense, if the gui is active.                                                                                                       |
| prefix      | Prefix (Optional, String, default: "") This is useful if print_this is an array/list. Each entry will then be new row with this prefix.                                                                                                                                               |
| suffix      | Suffix (Optional, String, default: "") Same like prefix but at the end of each line.                                                                                                                                                                                                  |
| findme      | (Optional, String, default: "") Recommended with length 10. String to find the message in the code. E.g. 10-digit random hex from <a href="https://onlinetools.com/random/generate-random-hexadecimal-numbers">https://onlinetools.com/random/generate-random-hexadecimal-numbers</a> |
| logfile_dir | (Optional, String, default: "tempdir()") The absolute path to folder where the logfile will be stored.                                                                                                                                                                                |
| headless    | (Optional, Boolean, default: TRUE) Indicating, if the function is run only in the console (headless = TRUE) or on a GUI frontend (headless = FALSE).                                                                                                                                  |
| reset       | (boolean, default = FALSE) Should all parameters be reset to their default values?                                                                                                                                                                                                    |

**Value**

No return value, called for side effects (see description).

**Examples**

```
DIZtools::log_set_defaults(logfile_dir = tempdir())
```

---

|                    |                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------|
| number_to_position | <i>Converts an integer number to its "verbal position". 1 -&gt; "1st", 2 -&gt; "2nd", 3 -&gt; "3rd", 4 -&gt; "4th", ...</i> |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------|

---

**Description**

Converts an integer number to its "verbal position". 1 -> "1st", 2 -> "2nd", 3 -> "3rd", 4 -> "4th", ...

**Usage**

```
number_to_position(x)
```

**Arguments**

x                      A number.

**Value**

Returns the input number as string with a new suffix depending on the numbers position in the numbers bar.

**Examples**

```
{
}
```

---

paste2

*Normal 'paste' function with additional 'collapse\_last' argument.*

---

**Description**

The base 'paste' function but with the add on to also supply a 'collapse\_last' value to change the 'collapse' argument at the last position. To get from "cat", "mouse", "dog" to a string "cat, mouse and dog", one simply needs to call 'paste(c("cat","mouse","dog"), collapse = ", ", collapse\_last = " and ")'.

**Usage**

```
paste2(..., collapse = NULL, collapse_last = NULL, sep = " ", recycle0 = FALSE)
```

**Arguments**

...                      one or more R objects, to be converted to character vectors.

collapse                an optional character string to separate the results. Not [NA\\_character\\_](#). When collapse is a string, the result is always a string ([character](#) of length 1).

collapse\_last          (string, optional) The string to use for the last instance while collapsing. All other elements will be pasted using the normal 'collapse' argument. If 'collapse' is not set, 'collapse\_last' will be ignored.

sep                      a character string to separate the terms. Not [NA\\_character\\_](#).

recycle0                [logical](#) indicating if zero-length character arguments should result in the zero-length [character](#)(0). Note that when collapse is a string, recycle0 does *not* recycle to zero-length, but to "".

**Value**

String. See ‘?paste’ for details.

**References**

<https://stackoverflow.com/a/38276239>

**Examples**

```
{
  paste2(c("cat", "mouse", "dog"),
        collapse = ", ",
        collapse_last = " and ")
#> [1] "cat, mouse and dog"
}
```

---

paste\_pct\_sum

*Get the percentage of two values pretty formatted.*

---

**Description**

Get the percentage of two values pretty formatted. Thanks to kapsner for the inspiration!

**Usage**

```
paste_pct_sum(
  x,
  pct_ref = 1,
  with_percent_sign = TRUE,
  with_absolute = TRUE,
  decimal_separator = ".",
  digits = 2
)
```

**Arguments**

|                   |                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------|
| x                 | (numeric) The absolute value.                                                                                   |
| pct_ref           | (numeric, Optional) The reference value to which the ratio of the absolute value x is calculated. Default is 1. |
| with_percent_sign | (boolean, Optional) Should a percentage sign be added to the final string? Default = TRUE                       |
| with_absolute     | (boolean, Optional) Should the two absolute reference values also be output? Default = TRUE                     |
| decimal_separator | (string, optional) The character to be used to indicate the numeric decimal point.                              |
| digits            | (int, optional) The number of digits after the decimal separator to round to.                                   |

**Value**

A character string.

**Examples**

```
paste_pct_sum(.15, 2)
#> "7.50% (0.15 of 2)"
```

---

|                  |                                                                                  |
|------------------|----------------------------------------------------------------------------------|
| pretty_timestamp | <i>Quickly get a pretty timestamp without need to handle format-options etc.</i> |
|------------------|----------------------------------------------------------------------------------|

---

**Description**

Function to quickly get a pretty timestamp without need to handle format-options etc.

**Usage**

```
pretty_timestamp(timestamp, no_spaces = FALSE)
```

**Arguments**

|           |                                                                                                                                                                                                                                                         |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| timestamp | A POSIXct timestamp or a string which can be converted to a POSIXct timestamp.                                                                                                                                                                          |
| no_spaces | Boolean. Default = 'FALSE'. Specifies whether the output can contain spaces or not. E.g. if the output is for human reading, 'no_spaces = FALSE' is a good option. As suffix for file names (e.g. logfiles), 'no_spaces = TRUE' might be a good option. |

**Value**

The timestamp in always the same format. #'

**Examples**

```
pretty_timestamp("2023-10-30 12:34:56", no_spaces = TRUE)
# Result: "2023-10-30T123456"
pretty_timestamp("2023-10-30 12:34:56")
# this is the same like
pretty_timestamp("2023-10-30 12:34:56", no_spaces = FALSE)
# Result: "30. Oct 2023 - 12:34 UTC"
```

---

 rep2
 

---



---

*Repeat something with the ability to also collapse the output.*


---

### Description

Repeat something with the ability to also collapse the output. The base `rep("ha", 3)` function does not support arguments like `'collapse'` or `'sep'` like `'paste(...)'`. `'rep2'` closes this gap.

### Usage

```
rep2(x, n, ...)
```

### Arguments

|     |                                                                                                           |
|-----|-----------------------------------------------------------------------------------------------------------|
| x   | The object to repeat                                                                                      |
| n   | The amount how often the object should be repeated                                                        |
| ... | Further arguments passed to <code>'paste'</code> (see <code>'help("paste")'</code> for more information). |

### Value

The result from `'paste(rep(x, n), sep = sep, collapse = collapse)'`

### Examples

```
## rep2 is the same like rep:
rep(x = "ha", 3)
#> "ha" "ha" "ha"
rep2(x = "ha", 3)
#> "ha" "ha" "ha"

## ... but you can also use the arguments from `paste`:
rep2(x = "ha", n = 3, collapse = "")
#> "hahaha"
```

---

 robust\_round
 

---



---

*Round numbers without problems.*


---

### Description

Round numbers without problems.

**Usage**

```
robust_round(
  x,
  digits = 2,
  thousands_separator = "",
  decimal_separator = ".",
  lower_indicator = TRUE
)
```

**Arguments**

**x** (numeric) The numeric input vector to round.

**digits** (int, optional) The number of digits after the decimal separator to round to.

**thousands\_separator** (string, optional) Used as mark between every 3 decimals before the decimal point.

**decimal\_separator** (string, optional) The character to be used to indicate the numeric decimal point.

**lower\_indicator** (Boolean, optional, default = TRUE) If the result is (since it is rounded) zero: Should there be displayed a lower-indicator? E.g. `DIZtools::robust_round(0.00001)` results internally in "0.00". The more intuitive result therefore would be "<0.01", which can be enabled using the parameter `'lower_indicator == TRUE'`.

**Value**

Rounded numbers as string.

**Examples**

```
{
  robust_round(c(1.234567, 987123.987654321))
  #> [1] "1.23" "987.99"
}
```

---

setdiff\_all

---

*Get the difference of two vectors in both directions.*


---

**Description**

The base-R function `'setdiff'` is asymmetric meaning `'setdiff(vec1, vec2)'` is not the same as `'setdiff(vec2, vec1)'`. Only the first vector will be compared to the second vector and all elements not contained in the second are in the resulting vector. So if you also want to include all elements being in the second vector but not in the first, you can use this function. In this case you are searching for elements being in the union of both vectors but not in the intersect of both vectors. This function is a symmetric function. It doesn't matter in which order you input the vectors, the content will be the same. Only the order of the elements inside the output differs.

**Usage**

```
setdiff_all(vec1, vec2)
```

**Arguments**

|      |               |
|------|---------------|
| vec1 | First vector  |
| vec2 | Second vector |

**Value**

The difference between both vectors.

**Examples**

```
## Not run:
vec1 <- c(1,2,3,4)
vec2 <- c(3,4,5,6)
# setdiff(vec1, vec2) = c(1,2)
# setdiff(vec2, vec1) = c(5,6)
# setdiff_all(vec1, vec2) = c(1,2,5,6)
# setdiff_all(vec2, vec1) = c(5,6,1,2)

## End(Not run)
```

---

setenv2

---

*Assign variables to the system environment.*


---

**Description**

Create a system environment variable with the use of variables. While ‘var.name = "testname"; var.value = 7’ and ‘Sys.setenv(var.name = var.value)’ will create ‘var.name = 7’ in the system environment, ‘DIZtools::setenv2(key = var.name, val = var.value)’ will create ‘testname = 7’ in the system environment.

**Usage**

```
setenv2(key, val)
```

**Arguments**

|     |                                                           |
|-----|-----------------------------------------------------------|
| key | A character (!) string. The name of the assigned variable |
| val | An object. The object that will be assigned to ‘key’.     |

**Value**

No return value, called for side effects (see description).

**See Also**

<https://stackoverflow.com/a/12533155>

**Examples**

```
var.name = "testname"
var.value = 7

Sys.setenv(var.name = var.value)

Sys.getenv("testname")
#> [1] ""
Sys.getenv("var.name")
#> [1] "7"

Sys.unsetenv("var.name")
Sys.unsetenv("testname")

setenv2(key = var.name, val = var.value)
Sys.getenv("testname")
#> [1] "7"
Sys.getenv("var.name")
#> [1] ""
```

---

|             |                                                                      |
|-------------|----------------------------------------------------------------------|
| setenv_file | <i>Set all variables of a '.env' file to the system environment.</i> |
|-------------|----------------------------------------------------------------------|

---

**Description**

Internal function to set environment variables that are necessary for the database connections with db\_connection. Old function name: 'set\_env\_vars()'.

**Usage**

```
setenv_file(env_file)
```

**Arguments**

|          |                                                                                                                              |
|----------|------------------------------------------------------------------------------------------------------------------------------|
| env_file | A character. The full path including the file name to the file containing the environment variable definitions to be loaded. |
|----------|------------------------------------------------------------------------------------------------------------------------------|

**Value**

No return value, called for side effects (see description)

**See Also**

Sys.setenv

**Examples**

```
## Not run: set_env_vars("./.env")
```

---

|                     |                                                       |
|---------------------|-------------------------------------------------------|
| string_replacements | <i>Clean string with a given set of replacements.</i> |
|---------------------|-------------------------------------------------------|

---

**Description**

This function provides the functionality to clean a string with a given set of replacements. This is e.g. useful to create filenames or paths that are not allowed to contain spaces.

**Usage**

```
string_replacements(
  input,
  replace_mapping = "default",
  tolower = FALSE,
  toupper = FALSE
)
```

**Arguments**

|                 |                                                                                                                                                         |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| input           | (string) The character string to be processed.                                                                                                          |
| replace_mapping | (Optional, list, default = "default") The mapping containing what should be replaced with what: 'replace_mapping <- list("replace_this" = "with_this")' |
| tolower         | (boolean, default = FALSE) Should the result be lowercase?                                                                                              |
| toupper         | (boolean, default = FALSE) Should the result be uppercase?                                                                                              |

**Value**

(String) All elements (names) of the input 'replace\_mapping' or the default mapping are replaced by its values of the mapping.

**Examples**

```
string_replacements(input = "Ab 20. April 2020 (((__(N = 1.234)"))
# Result: "Ab_20_April_2020_N_1234"
```

---

test\_check\_digit*Validate an ID Using the Check Digit (DIN ISO 7064, Mod 11,10)*

---

## Description

This function verifies whether a given ID is valid by checking its check digit using the DIN ISO 7064, Mod 11,10 algorithm.

## Usage

```
test_check_digit(test)
```

## Arguments

|      |                                                                                                                    |
|------|--------------------------------------------------------------------------------------------------------------------|
| test | A numeric or character string representing the ID. It should be exactly 10 digits long, including the check digit. |
|------|--------------------------------------------------------------------------------------------------------------------|

## Details

The function processes the input as follows: - If the input has 10 digits and does not start with '0', it is assumed to be a ID with a check digit. - If the input has 10 digits and starts with '0', it is considered an old ID without a check digit, and validation cannot be performed. - If the input has 9 digits, it lacks a check digit, so validation is not possible. - If the input format is invalid, an error message is generated.

The function extracts the main ID (without the check digit), computes the expected check digit using 'calculate\_check\_digit()', and compares it with the provided check digit.

## Value

A logical value: 'TRUE' if the check digit is correct, 'FALSE' otherwise. Returns 'FALSE' with an error message if the input format is invalid.

## Examples

```
test_check_digit("1000001381") # Returns TRUE if the check digit is correct
test_check_digit("1000001121") # Another valid ID
test_check_digit("1007002482") # Returns FALSE if the check digit is incorrect
```

---

|                 |                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------|
| time_diff_print | <i>Calculate time difference of two timestamps, round the value and return a string with suiting unit.</i> |
|-----------------|------------------------------------------------------------------------------------------------------------|

---

## Description

Create string with time difference in suitable unit. Additionally automatically add the remaining time depending on the position in an iteration process, or the estimated time of arrival by just providing the current and total iteration step(s). A more fancy option might be the package [progressr](#). See [progressr](#) for a corresponding code snippet.

## Usage

```
time_diff_print(
  older_timestamp,
  newer_timestamp = NULL,
  iteration = NULL,
  iterations = NULL,
  remaining_time = TRUE,
  eta = TRUE,
  prefix_iteration = "Iteration ",
  prefix_time_elapsed = "Time elapsed: ",
  prefix_time_remaining = "Remaining: ",
  prefix_eta = "ETA: ",
  digits = 2,
  thousands_separator = "",
  decimal_separator = "."
)
```

## Arguments

|                                                                          |                                                                                                                                         |
|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| older_timestamp                                                          | (POSIXct) Start time.                                                                                                                   |
| newer_timestamp                                                          | (POSIXct, Optional) End time. If not set, the current time will be used.                                                                |
| iteration                                                                | (Numeric, Optional) The current iteration if also the time process within all iterations additional to the elapsed time is of interest. |
| iterations                                                               | (Numeric, Optional) The total number of iterations.                                                                                     |
| remaining_time                                                           | (Boolean, Optional, Default = TRUE) Should the estimated time needed to finish all iterations be displayed?                             |
| eta                                                                      | (Boolean, Optional, Default = TRUE) Should the estimated time of arrival needed to finish all iterations be displayed?                  |
| prefix_iteration, prefix_time_elapsed, prefix_time_remaining, prefix_eta | Prefixes for the output string.                                                                                                         |

**digits** (int, optional) The number of digits after the decimal separator to round to.  
**thousands\_separator** (string, optional) Used as mark between every 3 decimals before the decimal point.  
**decimal\_separator** (string, optional) The character to be used to indicate the numeric decimal point.

### Value

A list with one element per row of the input file

### Examples

```
## Since no second timestamp is provided, the current time
## (currently 2023-03-08) will be assumed:
DIZtools::time_diff_print("2023-01-01 10:00")
#> [1] "Time elapsed: 66.20 days"
DIZtools::time_diff_print("2023-01-01 10:00", iteration = 7, iterations = 10)
#> [1] "Iteration 7 of 10 (70.00 %), Time elapsed: 66.20 days
#>      (Remaining: ~ 28.37 days, ETA: ~ 05. Apr 2023 - 23:42 UTC)"
```

---

|            |                                 |
|------------|---------------------------------|
| trim.space | <i>Trim Spaces of a string.</i> |
|------------|---------------------------------|

---

### Description

Removes leading and/or trailing space(s) from a character vector. By default, it removes both leading and trailing spaces.

### Usage

```
trim.space(
  x,
  what = c("both", "leading", "trailing", "none"),
  space.regex = "[:space:]",
  ...
)
```

### Arguments

**x** a character vector which values need whitespace trimming  
**what** which part of the string should be trimmed. Defaults to both which removes trailing and leading spaces. If none, no trimming will be performed.  
**space.regex** a character value containing a regex that defines a space character  
**...** additional arguments for [gsub](#) function

**Value**

a character vector with (hopefully) trimmed spaces

**Source**

Copied from 'rapportools::is.empty()'

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vgsub

*Vectorised string replacement.*

---

**Description**

A simple wrapper for [gsub](#) that replaces all patterns from `pattern` argument with ones in `replacement` over vector provided in argument `x`.

**Usage**

```
vgsub(pattern, replacement, x, ...)
```

**Arguments**

|                          |                                                          |
|--------------------------|----------------------------------------------------------|
| <code>pattern</code>     | see eponymous argument for <a href="#">gsub</a> function |
| <code>replacement</code> | see eponymous argument for <a href="#">gsub</a> function |
| <code>x</code>           | see eponymous argument for <a href="#">gsub</a> function |
| <code>...</code>         | additional arguments for <a href="#">gsub</a> function   |

**Value**

a character vector with string replacements

**Source**

Copied from package 'rapportools'

**References**

See original thread for more details <https://stackoverflow.com/a/6954308/457898>. Special thanks to user Jean-Robert for this one!

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|         |                                                          |
|---------|----------------------------------------------------------|
| %notin% | <i>notin helper function. Opposite of 'in' function.</i> |
|---------|----------------------------------------------------------|

---

**Description**

Function to return elements of x that are not in y.

**Usage**

```
x %notin% y
```

**Arguments**

|   |           |
|---|-----------|
| x | Object 1. |
| y | Object 2. |

**Value**

Returns the result of !

**Examples**

```
tmp1 <- c("a", "b", "c")
tmp2 <- c("b", "c", "d")
tmp1 %notin% tmp2
```

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