

# Package: xfun (via r-universe)

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**Type** Package

**Title** Supporting Functions for Packages Maintained by 'Yihui Xie'

**Version** 0.49.12

**Description** Miscellaneous functions commonly used in other packages maintained by 'Yihui Xie'.

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## Contents

alnum_id . . . . .	4
attr . . . . .	5
base64_encode . . . . .	5
base64_uri . . . . .	6

base_pkgs . . . . .	6
bg_process . . . . .	7
broken_packages . . . . .	8
bump_version . . . . .	8
cache_exec . . . . .	9
cache_rds . . . . .	10
crandalf_check . . . . .	13
csv_options . . . . .	14
decimal_dot . . . . .	15
del_empty_dir . . . . .	15
dir_create . . . . .	16
dir_exists . . . . .	16
divide_chunk . . . . .	17
download_cache . . . . .	18
download_file . . . . .	19
do_once . . . . .	19
embed_file . . . . .	20
env_option . . . . .	22
existing_files . . . . .	23
exit_call . . . . .	23
fenced_block . . . . .	24
file_ext . . . . .	25
file_rename . . . . .	26
file_string . . . . .	26
find_globals . . . . .	27
format_bytes . . . . .	28
from_root . . . . .	29
github_releases . . . . .	30
grep_sub . . . . .	30
gsub_file . . . . .	31
html_tag . . . . .	32
install_dir . . . . .	33
install_github . . . . .	34
in_dir . . . . .	34
is_abs_path . . . . .	35
is_ascii . . . . .	35
is_blank . . . . .	36
is_sub_path . . . . .	36
is_web_path . . . . .	37
is_windows . . . . .	38
join_words . . . . .	38
lazy_save . . . . .	39
magic_path . . . . .	40
mark_dirs . . . . .	41
md5 . . . . .	42
md_table . . . . .	42
mime_type . . . . .	43
msg_cat . . . . .	44

native_encode . . . . .	45
news2md . . . . .	46
new_app . . . . .	46
normalize_path . . . . .	47
numbers_to_words . . . . .	48
optipng . . . . .	49
parse_only . . . . .	49
pkg_attach . . . . .	50
pkg_bib . . . . .	51
process_file . . . . .	53
proc_kill . . . . .	54
proj_root . . . . .	54
prose_index . . . . .	55
protect_math . . . . .	56
raw_string . . . . .	57
read_all . . . . .	58
read_bin . . . . .	58
read_utf8 . . . . .	59
record . . . . .	60
record_print . . . . .	62
relative_path . . . . .	63
rename_seq . . . . .	64
rest_api . . . . .	65
retry . . . . .	66
rev_check . . . . .	67
Rscript . . . . .	69
Rscript_call . . . . .	70
rstudio_type . . . . .	71
same_path . . . . .	72
session_info . . . . .	72
set_envvar . . . . .	73
shrink_images . . . . .	74
split_lines . . . . .	75
split_source . . . . .	75
strict_list . . . . .	76
strip_html . . . . .	77
str_wrap . . . . .	78
submit_cran . . . . .	78
system3 . . . . .	79
tabset . . . . .	79
taml_load . . . . .	80
tinify . . . . .	81
tojson . . . . .	83
tree . . . . .	84
try_error . . . . .	84
try_silent . . . . .	85
upload_ftp . . . . .	85
upload_imgur . . . . .	86

url_accessible . . . . .	88
url_filename . . . . .	88
valid_syntax . . . . .	89
yaml_body . . . . .	90
yaml_load . . . . .	90

<b>Index</b>	<b>92</b>
--------------	-----------

---

alnum_id	<i>Generate ID strings</i>
----------	----------------------------

---

### Description

Substitute certain (by default, non-alphanumeric) characters with dashes and remove extra dashes at both ends to generate ID strings. This function is intended for generating IDs for HTML elements, so HTML tags in the input text will be removed first.

### Usage

```
alnum_id(x, exclude = "[^[:alnum:]]+")
```

### Arguments

x	A character vector.
exclude	A (Perl) regular expression to detect characters to be replaced by dashes. By default, non-alphanumeric characters are replaced.

### Value

A character vector of IDs.

### Examples

```
x = c("Hello world 123!", "a &b*^##c 456")
xfun::alnum_id(x)
xfun::alnum_id(x, "[^[:alpha:]]+") # only keep alphabetical chars
# when text contains HTML tags
xfun::alnum_id("<h1>Hello <strong>world</strong>!")
```

---

attr	<i>Obtain an attribute of an object without partial matching</i>
------	--

---

**Description**

An abbreviation of `base::attr(exact = TRUE)`.

**Usage**

```
attr(...)
```

**Arguments**

... Passed to `base::attr()` (without the exact argument).

**Examples**

```
z = structure(list(a = 1), foo = 2)
base::attr(z, "f") # 2
xfun::attr(z, "f") # NULL
xfun::attr(z, "foo") # 2
```

---

base64_encode	<i>Encode/decode data into/from base64 encoding.</i>
---------------	--

---

**Description**

The function `base64_encode()` encodes a file or a raw vector into the base64 encoding. The function `base64_decode()` decodes data from the base64 encoding.

**Usage**

```
base64_encode(x)
```

```
base64_decode(x, from = NA)
```

**Arguments**

x	For <code>base64_encode()</code> , a raw vector. If not raw, it is assumed to be a file or a connection to be read via <code>readBin()</code> . For <code>base64_decode()</code> , a string.
from	If provided (and x is not provided), a connection or file to be read via <code>readChar()</code> , and the result will be passed to the argument x.

**Value**

`base64_encode()` returns a character string. `base64_decode()` returns a raw vector.

**Examples**

```
xfun::base64_encode(as.raw(1:10))
logo = xfun::R_logo()
xfun::base64_encode(logo)
xfun::base64_decode("AQIDBAUGBwgJCg==")
```

---

base64_uri	<i>Generate the Data URI for a file</i>
------------	---

---

**Description**

Encode the file in the base64 encoding, and add the media type. The data URI can be used to embed data in HTML documents, e.g., in the src attribute of the `<img />` tag.

**Usage**

```
base64_uri(x, type = mime_type(x))
```

**Arguments**

x	A file path.
type	The MIME type of the file, e.g., "image/png" for a PNG image file.

**Value**

A string of the form `data:<media type>;base64,<data>`.

**Examples**

```
logo = xfun::R_logo()
img = xfun::html_tag("img", src = xfun::base64_uri(logo), alt = "R logo")
if (interactive()) xfun::html_view(img)
```

---

base_pkgs	<i>Get base R package names</i>
-----------	---------------------------------

---

**Description**

Return base R package names.

**Usage**

```
base_pkgs()
```

**Value**

A character vector of base R package names.

## Examples

```
xfun::base_pkgs()
```

---

bg_process	<i>Start a background process</i>
------------	-----------------------------------

---

## Description

Start a background process using the PowerShell cmdlet `Start-Process-PassThru` on Windows or the ampersand `&` on Unix, and return the process ID.

## Usage

```
bg_process(  
  command,  
  args = character(),  
  verbose = getOption("xfun.bg_process.verbose", FALSE)  
)
```

## Arguments

command, args	The system command and its arguments. They do not need to be quoted, since they will be quoted via <code>shQuote()</code> internally.
verbose	If FALSE, suppress the output from stdout (and also stderr on Windows). The default value of this argument can be set via a global option, e.g., <code>options(xfun.bg_process.verbose = TRUE)</code> .

## Value

The process ID as a character string.

## Note

On Windows, if PowerShell is not available, try to use `system2(wait = FALSE)` to start the background process instead. The process ID will be identified from the output of the command `tasklist`. This method of looking for the process ID may not be reliable. If the search is not successful in 30 seconds, it will throw an error (timeout). If a longer time is needed, you may set `options(xfun.bg_process.timeout)` to a larger value, but it should be very rare that a process cannot be started in 30 seconds. When you reach the timeout, it is more likely that the command actually failed.

## See Also

[proc\\_kill\(\)](#) to kill a process.

---

broken_packages	<i>Find out broken packages and reinstall them</i>
-----------------	--

---

**Description**

If a package is broken (i.e., not `loadable()`), reinstall it.

**Usage**

```
broken_packages(reinstall = TRUE)
```

**Arguments**

`reinstall` Whether to reinstall the broken packages, or only list their names.

**Details**

Installed R packages could be broken for several reasons. One common reason is that you have upgraded R to a newer `x.y` version, e.g., from `4.0.5` to `4.1.0`, in which case you need to reinstall previously installed packages.

**Value**

A character vector of names of broken package.

---

bump_version	<i>Bump version numbers</i>
--------------	-----------------------------

---

**Description**

Increase the last digit of version numbers, e.g., from `0.1` to `0.2`, or `7.23.9` to `7.23.10`.

**Usage**

```
bump_version(x)
```

**Arguments**

`x` A vector of version numbers (of the class `"numeric_version"`), or values that can be coerced to version numbers via `as.numeric_version()`.

**Value**

A vector of new version numbers.

**Examples**

```
xfun::bump_version(c("0.1", "91.2.14"))
```



---

 cache\_exec

*Cache the execution of an expression in memory or on disk*


---

### Description

Caching is based on the assumption that if the input does not change, the output will not change. After an expression is executed for the first time, its result will be saved (either in memory or on disk). The next run will be skipped and the previously saved result will be loaded directly if all external inputs of the expression remain the same, otherwise the cache will be invalidated and the expression will be re-executed.

### Usage

```
cache_exec(expr, path = "cache/", id = NULL, ...)
```

### Arguments

expr	An R expression to be cached.
path	The path to save the cache. The special value ":memory:" means in-memory caching. If it is intended to be a directory path, please make sure to add a trailing slash.
id	A stable and unique string identifier for the expression to be used to identify a unique copy of cache for the current expression from all cache files (or in-memory elements). If not provided, an MD5 digest of the <a href="#">deparsed</a> expression will be used, which means if the expression does not change (changes in comments or white spaces do not matter), the id will remain the same. This may not be a good default is two identical expressions are cached under the same path, because they could overwrite each other's cache when one expression's cache is invalidated, which may or may not be what you want. If you do not want that to happen, you need to manually provide an id.
...	More arguments to control the behavior of caching (see 'Details').

### Details

Arguments supported in ... include:

- vars: Names of local variables (which are created inside the expression). By default, local variables are automatically detected from the expression via [find\\_locals\(\)](#). Locally created variables are cached along with the value of the expression.
- hash and extra: R objects to be used to determine if cache should be loaded or invalidated. If (the MD5 hash of) the objects is not changed, the cache is loaded, otherwise the cache is invalidated and rebuilt. By default, hash is a list of values of global variables in the expression (i.e., variables created outside the expression). Global variables are automatically detected by [find\\_globals\(\)](#). You can provide a vector of names to override the automatic detection if you want some specific global variables to affect caching, or the automatic detection is not reliable. You can also provide additional information via the extra argument. For example, if

the expression reads an external file `foo.csv`, and you want the cache to be invalidated after the file is modified, you may use `extra = file.mtime("foo.csv")`.

- `keep`: By default, only one copy of the cache corresponding to an `id` under `path` is kept, and all other copies for this `id` is automatically purged. If `TRUE`, all copies of the cache are kept. If `FALSE`, all copies are removed, which means the cache is *always* invalidated, and can be useful to force re-executing the expression.
- `rw`: A list of functions to read/write the cache files. The list is of the form `list(name = 'xxx', load = function(file) {}, save = function(x, file) {})`. By default, `readRDS()` and `saveRDS()` are used. This argument can also take a character string to use some built-in read/write methods. Currently available methods include `rds` (the default), `raw` (using `serialize()` and `unserialize()`), and `qs` (using `qs::qread()` and `qs::qsave()`). The `rds` and `raw` methods only use base R functions (the `rds` method generates smaller files because it uses compression, but is often slower than the `raw` method, which does not use compression). The `qs` method requires the `qs` package, which can be much faster than base R methods and also supports compression.

## Value

If the cache is found, the cached value of the expression will be loaded and returned (other local variables will also be lazy-loaded into the current environment as a side-effect). If cache does not exist, the expression is executed and its value is returned.

## Examples

```
# the first run takes about 1 second
y1 = xfun::cache_exec({
  x = rnorm(1e+05)
  Sys.sleep(1)
  x
}, path = ":memory:", id = "sim-norm")

# the second run takes almost no time
y2 = xfun::cache_exec({
  # comments won't affect caching
  x = rnorm(1e+05)
  Sys.sleep(1)
  x
}, path = ":memory:", id = "sim-norm")

# y1, y2, and x should be identical
stopifnot(identical(y1, y2), identical(y1, x))
```

---

cache\_rds

*Cache the value of an R expression to an RDS file*

---

## Description

Save the value of an expression to a cache file (of the RDS format). Next time the value is loaded from the file if it exists.

**Usage**

```
cache_rds(
  expr = {
  },
  rerun = FALSE,
  file = "cache.rds",
  dir = "cache/",
  hash = NULL,
  clean = getOption("xfun.cache_rds.clean", TRUE),
  ...
)
```

**Arguments**

expr	An R expression.
rerun	Whether to delete the RDS file, rerun the expression, and save the result again (i.e., invalidate the cache if it exists).
file	The <i>base</i> (see Details) cache filename under the directory specified by the <code>dir</code> argument. If not specified and this function is called inside a code chunk of a <b>knitr</b> document (e.g., an R Markdown document), the default is the current chunk label plus the extension <code>‘.rds’</code> .
dir	The path of the RDS file is partially determined by <code>paste0(dir, file)</code> . If not specified and the <b>knitr</b> package is available, the default value of <code>dir</code> is the <b>knitr</b> chunk option <code>cache.path</code> (so if you are compiling a <b>knitr</b> document, you do not need to provide this <code>dir</code> argument explicitly), otherwise the default is <code>‘cache/’</code> . If you do not want to provide a <code>dir</code> but simply a valid path to the <code>file</code> argument, you may use <code>dir = “”</code> .
hash	A list object that contributes to the MD5 hash of the cache filename (see Details). It can also take a special character value <code>“auto”</code> . Other types of objects are ignored.
clean	Whether to clean up the old cache files automatically when <code>expr</code> has changed.
...	Other arguments to be passed to <code>saveRDS()</code> .

**Details**

Note that the `file` argument does not provide the full cache filename. The actual name of the cache file is of the form `‘BASENAME_HASH.rds’`, where `‘BASENAME’` is the base name provided via the `‘file’` argument (e.g., if `file = ‘foo.rds’`, `BASENAME` would be `‘foo’`), and `‘HASH’` is the MD5 hash (also called the `‘checksum’`) calculated from the R code provided to the `expr` argument and the value of the `hash` argument, which means when the code or the `hash` argument changes, the `‘HASH’` string may also change, and the old cache will be invalidated (if it exists). If you want to find the cache file, look for `‘.rds’` files that contain 32 hexadecimal digits (consisting of 0-9 and a-z) at the end of the filename.

The possible ways to invalidate the cache are: 1) change the code in `expr` argument; 2) delete the cache file manually or automatically through the argument `rerun = TRUE`; and 3) change the value of the `hash` argument. The first two ways should be obvious. For the third way, it makes it possible

to automatically invalidate the cache based on changes in certain R objects. For example, when you run `cache_rds({ x + y })`, you may want to invalidate the cache to rerun `{ x + y }` when the value of `x` or `y` has been changed, and you can tell `cache_rds()` to do so by `cache_rds({ x + y }, hash = list(x, y))`. The value of the argument `hash` is expected to be a list, but it can also take a special value, "auto", which means `cache_rds(expr)` will try to automatically figure out the global variables in `expr`, return a list of their values, and use this list as the actual value of `hash`. This behavior is most likely to be what you really want: if the code in `expr` uses an external global variable, you may want to invalidate the cache if the value of the global variable has changed. Here a "global variable" means a variable not created locally in `expr`, e.g., for `cache_rds({ x <- 1; x + y })`, `x` is a local variable, and `y` is (most likely to be) a global variable, so changes in `y` should invalidate the cache. However, you know your own code the best. If you want to be completely sure when to invalidate the cache, you can always provide a list of objects explicitly rather than relying on `hash = "auto"`.

By default (the argument `clean = TRUE`), old cache files will be automatically cleaned up. Sometimes you may want to use `clean = FALSE` (set the R global option `options(xfun.cache_rds.clean = FALSE)` if you want `FALSE` to be the default). For example, you may not have decided which version of code to use, and you can keep the cache of both versions with `clean = FALSE`, so when you switch between the two versions of code, it will still be fast to run the code.

### Value

If the cache file does not exist, run the expression and save the result to the file, otherwise read the cache file and return the value.

### Note

Changes in the code in the `expr` argument do not necessarily always invalidate the cache, if the changed code is [parsed](#) to the same expression as the previous version of the code. For example, if you have run `cache_rds({ Sys.sleep(5); 1+1 })` before, running `cache_rds({ Sys.sleep( 5 ) ; 1 + 1 })` will use the cache, because the two expressions are essentially the same (they only differ in white spaces). Usually you can add/delete white spaces or comments to your code in `expr` without invalidating the cache. See the package vignette `vignette('xfun', package = 'xfun')` for more examples.

When this function is called in a code chunk of a **knitr** document, you may not want to provide the filename or directory of the cache file, because they have reasonable defaults.

Side-effects (such as plots or printed output) will not be cached. The cache only stores the last value of the expression in `expr`.

### See Also

[cache\\_exec\(\)](#), which is more flexible (e.g., it supports in-memory caching and different read/write methods for cache files).

### Examples

```
f = tempfile() # the cache file
compute = function(...) {
  res = xfun::cache_rds({
    Sys.sleep(1)
```

```

      1:10
    }, file = f, dir = "", ...)
  res
}
compute() # takes one second
compute() # returns 1:10 immediately
compute() # fast again
compute(rerun = TRUE) # one second to rerun
compute()
unlink(paste0(f, "_*.rds"))

```

---

crandalf_check	<i>Submit check jobs to crandalf</i>
----------------	--------------------------------------

---

## Description

Check the reverse dependencies of a package using the crandalf service: <https://github.com/yihui/crandalf>. If the number of reverse dependencies is large, they will be split into batches and pushed to crandalf one by one.

## Usage

```

crandalf_check(pkg, size = 400, jobs = Inf, which = "all")

crandalf_results(pkg, repo = NA, limit = 200, wait = 5 * 60)

```

## Arguments

pkg	The package name of which the reverse dependencies are to be checked.
size	The number of reverse dependencies to be checked in each job.
jobs	The number of jobs to run in GitHub Actions (by default, all jobs are submitted, but you can choose to submit the first few jobs).
which	The type of dependencies (see <a href="#">rev_check()</a> ).
repo	The crandalf repo on GitHub (of the form user/repo such as "yihui/crandalf"). Usually you do not need to specify it, unless you are not calling this function inside the crandalf project, because gh should be able to figure out the repo automatically.
limit	The maximum of records for gh run list to retrieve. You only need a larger number if the check results are very early in the GitHub Action history.
wait	Number of seconds to wait if not all jobs have been completed on GitHub. By default, this function checks the status every 5 minutes until all jobs are completed. Set wait to 0 to disable waiting (and throw an error immediately when any jobs are not completed).

## Details

Due to the time limit of a single job on GitHub Actions (6 hours), you will have to split the large number of reverse dependencies into batches and check them sequentially on GitHub (at most 5 jobs in parallel). The function `crandalf_check()` does this automatically when necessary. It requires the `git` command to be available.

The function `crandalf_results()` fetches check results from GitHub after all checks are completed, merge the results, and show a full summary of check results. It requires `gh` (GitHub CLI: <https://cli.github.com/manual/>) to be installed and you also need to authenticate with your GitHub account beforehand.

---

csv\_options

*Parse comma-separated chunk options*

---

## Description

For **knitr** and R Markdown documents, code chunk options can be written using the comma-separated syntax (e.g., `opt1=value1, opt2=value2`). This function parses these options and returns a list. If an option is not named, it will be treated as the chunk label.

## Usage

```
csv_options(x)
```

## Arguments

`x` The chunk options as a string.

## Value

A list of chunk options.

## Examples

```
xfun::csv_options("foo, eval=TRUE, fig.width=5, echo=if (TRUE) FALSE")
```

---

decimal_dot	<i>Evaluate an expression after forcing the decimal point to be a dot</i>
-------------	---

---

**Description**

Sometimes it is necessary to use the dot character as the decimal separator. In R, this could be affected by two settings: the global option `options(OutDec)` and the `LC_NUMERIC` locale. This function sets the former to `.` and the latter to `C` before evaluating an expression, such as coercing a number to character.

**Usage**

```
decimal_dot(x)
```

**Arguments**

x	An expression.
---	----------------

**Value**

The value of x.

**Examples**

```
opts = options(OutDec = ",")
as.character(1.234) # using ',' as the decimal separator
print(1.234) # same
xfun::decimal_dot(as.character(1.234)) # using dot
xfun::decimal_dot(print(1.234)) # using dot
options(opts)
```

---

del_empty_dir	<i>Delete an empty directory</i>
---------------	----------------------------------

---

**Description**

Use `list.file()` to check if there are any files or subdirectories under a directory. If not, delete this empty directory.

**Usage**

```
del_empty_dir(dir)
```

**Arguments**

dir	Path to a directory. If NULL or the directory does not exist, no action will be performed.
-----	--

---

dir_create	<i>Create a directory recursively by default</i>
------------	--

---

**Description**

First check if a directory exists. If it does, return TRUE, otherwise create it with `dir.create(recursive = TRUE)` by default.

**Usage**

```
dir_create(x, recursive = TRUE, ...)
```

**Arguments**

x	A path name.
recursive	Whether to create all directory components in the path.
...	Other arguments to be passed to <code>dir.create()</code> .

**Value**

A logical value indicating if the directory either exists or is successfully created.

---

dir_exists	<i>Test the existence of files and directories</i>
------------	--

---

**Description**

These are wrapper functions of `[utils::file_test()]` to test the existence of directories and files. Note that `file_exists()` only tests files but not directories, which is the main difference between `file.exists()` in base R. If you use are using the R version 3.2.0 or above, `dir_exists()` is the same as `dir.exists()` in base R.

**Usage**

```
dir_exists(x)
```

```
file_exists(x)
```

**Arguments**

x	A vector of paths.
---	--------------------

**Value**

A logical vector.



---

`divide_chunk`*Divide chunk options from the code chunk body*

---

## Description

Chunk options can be written in special comments (e.g., after `#|` for R code chunks) inside a code chunk. This function partitions these options from the chunk body.

## Usage

```
divide_chunk(engine, code)
```

## Arguments

<code>engine</code>	The name of the language engine (to determine the appropriate comment character).
<code>code</code>	A character vector (lines of code).

## Value

A list with the following items:

- `options`: The parsed options (if there are any) as a list.
- `src`: The part of the input that contains the options.
- `code`: The part of the input that contains the code.

## Note

Chunk options must be written on *continuous* lines (i.e., all lines must start with the special comment prefix such as `#|`) at the beginning of the chunk body.

## Examples

```
# parse yaml-like items
yaml_like = c("#| label: mine", "#| echo: true", "#| fig.width: 8", "#| foo: bar",
             "1 + 1")
writeLines(yaml_like)
xfun::divide_chunk("r", yaml_like)

# parse CSV syntax
csv_like = c("#| mine, echo = TRUE, fig.width = 8, foo = 'bar'", "1 + 1")
writeLines(csv_like)
xfun::divide_chunk("r", csv_like)
```

---

`download_cache`*Download a file from a URL and cache it on disk*

---

## Description

This object provides methods to download files and cache them on disk.

## Usage

```
download_cache
```

## Format

A list of methods:

- `$get(url, type, handler)` downloads a URL, caches it, and returns the file content according to the value of `type` (possible values: "text" means the text content; "base64" means the base64 encoded data; "raw" means the raw binary content; "auto" is the default and means the type is determined by the content type in the URL headers). Optionally a handler function can be applied to the content.
- `$list()` gives the list of cache files.
- `$summary()` gives a summary of existing cache files.
- `$remove(url, type)` removes a single cache file.
- `$purge()` deletes all cache files.

## Examples

```
# the first time it may take a few seconds
x1 = xfun::download_cache$get("https://www.r-project.org/")
head(x1)

# now you can get the cached content
x2 = xfun::download_cache$get("https://www.r-project.org/")
identical(x1, x2) # TRUE

# a binary file
x3 = xfun::download_cache$get("https://yihui.org/images/logo.png", "raw")
length(x3)

# show a summary
xfun::download_cache$summary()
# remove a specific cache file
xfun::download_cache$remove("https://yihui.org/images/logo.png", "raw")
# remove all cache files
xfun::download_cache$purge()
```

---

download_file	<i>Try various methods to download a file</i>
---------------	---

---

### Description

Try all possible methods in `download.file()` (e.g., `libcurl`, `curl`, `wget`, and `wininet`) and see if any method can succeed. The reason to enumerate all methods is that sometimes the default method does not work, e.g., <https://stat.ethz.ch/pipermail/r-devel/2016-June/072852.html>.

### Usage

```
download_file(
  url,
  output = url_filename(url),
  ...,
  .error = "No download method works (auto/wininet/wget/curl/lynx)"
)
```

### Arguments

<code>url</code>	The URL of the file.
<code>output</code>	Path to the output file. By default, it is determined by <code>url_filename()</code> .
<code>...</code>	Other arguments to be passed to <code>download.file()</code> (except <code>method</code> ).
<code>.error</code>	An error message to signal when the download fails.

### Value

The integer code `0` for success, or an error if none of the methods work.

### Note

To allow downloading large files, the `timeout` option in `options()` will be temporarily set to one hour (3600 seconds) inside this function when this option has the default value of 60 seconds. If you want a different `timeout` value, you may set it via `options(timeout = N)`, where `N` is the number of seconds (not 60).

---

do_once	<i>Perform a task once in an R session</i>
---------	--

---

### Description

Perform a task once in an R session, e.g., emit a message or warning. Then give users an optional hint on how not to perform this task at all.

**Usage**

```
do_once(
  task,
  option,
  hint = c("You will not see this message again in this R session.",
           "If you never want to see this message,",
           sprintf("you may set options(%s = FALSE) in your .Rprofile.", option))
)
```

**Arguments**

task	Any R code expression to be evaluated once to perform a task, e.g., <code>warning('Danger!')</code> or <code>message('Today is ', Sys.Date())</code> .
option	An R option name. This name should be as unique as possible in <code>options()</code> . After the task has been successfully performed, this option will be set to FALSE in the current R session, to prevent the task from being performed again the next time when <code>do_once()</code> is called.
hint	A character vector to provide a hint to users on how not to perform the task or see the message again in the current R session. Set <code>hint = ""</code> if you do not want to provide the hint.

**Value**

The value returned by the task, invisibly.

**Examples**

```
do_once(message("Today's date is ", Sys.Date()), "xfun.date.reminder")
# if you run it again, it will not emit the message again
do_once(message("Today's date is ", Sys.Date()), "xfun.date.reminder")

do_once({
  Sys.sleep(2)
  1 + 1
}, "xfun.task.1plus1")
do_once({
  Sys.sleep(2)
  1 + 1
}, "xfun.task.1plus1")
```

**Description**

For a file, first encode it into base64 data (a character string). Then generate a hyperlink of the form ‘<a href="base64 data" download="filename">Download filename</a>’. The file can be downloaded when the link is clicked in modern web browsers. For a directory, it will be compressed as a zip archive first, and the zip file is passed to `embed_file()`. For multiple files, they are also compressed to a zip file first.

**Usage**

```
embed_file(path, name = basename(path), text = paste("Download", name), ...)
```

```
embed_dir(path, name = paste0(normalize_path(path), ".zip"), ...)
```

```
embed_files(path, name = with_ext(basename(path[1]), ".zip"), ...)
```

**Arguments**

<code>path</code>	Path to the file(s) or directory.
<code>name</code>	The default filename to use when downloading the file. Note that for <code>embed_dir()</code> , only the base name (of the zip filename) will be used.
<code>text</code>	The text for the hyperlink.
<code>...</code>	For <code>embed_file()</code> , additional arguments to be passed to <code>html_tag()</code> (e.g., <code>class = 'foo'</code> ). For <code>embed_dir()</code> and <code>embed_files()</code> , arguments passed to <code>embed_file()</code> .

**Details**

These functions can be called in R code chunks in R Markdown documents with HTML output formats. You may embed an arbitrary file or directory in the HTML output file, so that readers of the HTML page can download it from the browser. A common use case is to embed data files for readers to download.

**Value**

An HTML tag ‘<a>’ with the appropriate attributes.

**Note**

Windows users may need to install Rtools to obtain the zip command to use `embed_dir()` and `embed_files()`.

Internet Explorer does not support downloading embedded files. Chrome has a 2MB limit on the file size.

**Examples**

```
logo = xfun::R_logo()
link = xfun::embed_file(logo, text = "Download R logo")
link
if (interactive()) xfun::html_view(link)
```

---

env_option	<i>Retrieve a global option from both options() and environment variables</i>
------------	---

---

### Description

If the option exists in `options()`, use its value. If not, query the environment variable with the name `R_NAME` where `NAME` is the capitalized option name with dots substituted by underscores. For example, for an option `xfun.foo`, first we try `getOption('xfun.foo')`; if it does not exist, we check the environment variable `R_XFUN_FOO`.

### Usage

```
env_option(name, default = NULL)
```

### Arguments

name	The option name.
default	The default value if the option is not found in <code>options()</code> or environment variables.

### Details

This provides two possible ways, whichever is more convenient, for users to set an option. For example, global options can be set in the [.Rprofile](#) file, and environment variables can be set in the [.Renviron](#) file.

### Value

The option value.

### Examples

```
xfun::env_option("xfun.test.option") # NULL

Sys.setenv(R_XFUN_TEST_OPTION = "1234")
xfun::env_option("xfun.test.option") # 1234

options(xfun.test.option = TRUE)
xfun::env_option("xfun.test.option") # TRUE (from options())
options(xfun.test.option = NULL) # reset the option
xfun::env_option("xfun.test.option") # 1234 (from env var)

Sys.unsetenv("R_XFUN_TEST_OPTION")
xfun::env_option("xfun.test.option") # NULL again

xfun::env_option("xfun.test.option", FALSE) # use default
```

---

existing_files	<i>Find file paths that exist</i>
----------------	-----------------------------------

---

**Description**

This is a shorthand of `x[file.exists(x)]`, and optionally returns the first existing file path.

**Usage**

```
existing_files(x, first = FALSE, error = TRUE)
```

**Arguments**

<code>x</code>	A vector of file paths.
<code>first</code>	Whether to return the first existing path. If TRUE and no specified files exist, it will signal an error unless the argument <code>error = FALSE</code> .
<code>error</code>	Whether to throw an error when <code>first = TRUE</code> but no files exist. It can also take a character value, which will be used as the error message.

**Value**

A vector of existing file paths.

**Examples**

```
xfun::existing_files(c("foo.txt", system.file("DESCRIPTION", package = "xfun")))
```

---

exit_call	<i>Call on.exit() in a parent function</i>
-----------	--

---

**Description**

The function `on.exit()` is often used to perform tasks when the current function exits. This `exit_call()` function allows calling a function when a parent function exits (thinking of it as inserting an `on.exit()` call into the parent function).

**Usage**

```
exit_call(fun, n = 2, ...)
```

**Arguments**

<code>fun</code>	A function to be called when the parent function exits.
<code>n</code>	The parent frame number. For <code>n = 1</code> , <code>exit_call(fun)</code> is the same as <code>on.exit(fun()); n = 2</code> means adding <code>on.exit(fun())</code> in the parent function; <code>n = 3</code> means the grandparent, etc.
<code>...</code>	Other arguments to be passed to <code>on.exit()</code> .

## References

This function was inspired by Kevin Ushey: <https://yihui.org/en/2017/12/on-exit-parent/>

## Examples

```
f = function(x) {
  print(x)
  xfun::exit_call(function() print("The parent function is exiting!"))
}
g = function(y) {
  f(y)
  print("f() has been called!")
}
g("An argument of g(!)")
```

---

fenced\_block

*Create a fenced block in Markdown*

---

## Description

Wrap content with fence delimiters such as backticks (code blocks) or colons (fenced Div). Optionally the fenced block can have attributes. The function `fenced_div()` is a shorthand of `fenced_block(char = ':')`.

## Usage

```
fenced_block(x, attrs = NULL, fence = make_fence(x, char), char = "`")
```

```
fenced_div(...)
```

```
make_fence(x, char = "`", start = 3)
```

## Arguments

<code>x</code>	A character vector of the block content.
<code>attrs</code>	A vector of block attributes.
<code>fence</code>	The fence string, e.g., <code>:::</code> or <code>```</code> . This will be generated from the <code>char</code> argument by default.
<code>char</code>	The fence character to be used to generate the fence string by default.
<code>...</code>	Arguments to be passed to <code>fenced_block()</code> .
<code>start</code>	The number of characters to start searching <code>x</code> with. If the string of this number of characters is found, add one more character, and repeat the search.

## Value

`fenced_block()` returns a character vector that contains both the fences and content.

`make_fence()` returns a character string. If the block content contains `N` fence characters (e.g., backticks), use `N + 1` characters as the fence.



**Examples**

```
# code block with class 'r' and ID 'foo'
xfun::fenced_block("1+1", c(".r", "#foo"))
# fenced Div
xfun::fenced_block("This is a Div.", char = ":")
# three backticks by default
xfun::make_fence("1+1")
# needs five backticks for the fences because content has four
xfun::make_fence(c("````r", "1+1", "````"))
```

---

file\_ext

---

*Manipulate filename extensions*


---

**Description**

Functions to obtain (`file_ext()`), remove (`sans_ext()`), and change (`with_ext()`) extensions in filenames.

**Usage**

```
file_ext(x, extra = "")
```

```
sans_ext(x, extra = "")
```

```
with_ext(x, ext, extra = "")
```

**Arguments**

<code>x</code>	A character of file paths.
<code>extra</code>	Extra characters to be allowed in the extensions. By default, only alphanumeric characters are allowed (and also some special cases in ‘Details’). If other characters should be allowed, they can be specified in a character string, e.g., “-+!_#”.
<code>ext</code>	A vector of new extensions. It must be either of length 1, or the same length as <code>x</code> .

**Details**

`file_ext()` is similar to `tools::file_ext()`, and `sans_ext()` is similar to `tools::file_path_sans_ext()`. The main differences are that they treat `tar.(gz|bz2|xz)` and `nb.html` as extensions (but functions in the **tools** package doesn’t allow double extensions by default), and allow characters `~` and `#` to be present at the end of a filename.

**Value**

A character vector of the same length as `x`.

**Examples**

```

library(xfun)
p = c("abc.doc", "def123.tex", "path/to/foo.Rmd", "backup.ppt~", "pkg.tar.xz")
file_ext(p)
sans_ext(p)
with_ext(p, ".txt")
with_ext(p, c(".ppt", ".sty", ".Rnw", "doc", "zip"))
with_ext(p, "html")

# allow for more characters in extensions
p = c("a.c++", "b.c--", "c.e##")
file_ext(p) # -/+/# not recognized by default
file_ext(p, extra = "-+#")

```

---

file_rename	<i>Rename files and directories</i>
-------------	-------------------------------------

---

**Description**

First try `file.rename()`. If it fails (e.g., renaming a file from one volume to another on disk is likely to fail), try `file.copy()` instead, and clean up the original files if the copy succeeds.

**Usage**

```
file_rename(from, to)
```

**Arguments**

from, to            Original and target paths, respectively.

**Value**

A logical vector (TRUE for success and FALSE for failure).

---

file_string	<i>Read a text file and concatenate the lines by '\n'</i>
-------------	---

---

**Description**

The source code of this function should be self-explanatory.

**Usage**

```
file_string(file)
```

**Arguments**

file                    Path to a text file (should be encoded in UTF-8).

**Value**

A character string of text lines concatenated by '\n'.

**Examples**

```
xfun::file_string(system.file("DESCRIPTION", package = "xfun"))
```

---

find\_globals

*Find global/local variables in R code*

---

**Description**

Use `codetools::findGlobals()` and `codetools::findLocalsList()` to find global and local variables in a piece of code. Global variables are defined outside the code, and local variables are created inside the code.

**Usage**

```
find_globals(code, envir = parent.frame())
```

```
find_locals(code)
```

**Arguments**

code                    Either a character vector of R source code, or an R expression.

envir                   The global environment in which global variables are to be found.

**Value**

A character vector of the variable names. If the source code contains syntax errors, an empty character vector will be returned.

**Note**

Due to the flexibility of creating and getting variables in R, these functions are not guaranteed to find all possible variables in the code (e.g., when the code is hidden behind `eval()`).

**Examples**

```
x = 2
xfun::find_globals("y = x + 1")
xfun::find_globals("y = get('x') + 1") # x is not recognized
xfun::find_globals("y = zzz + 1") # zzz doesn't exist

xfun::find_locals("y = x + 1")
xfun::find_locals("assign('y', x + 1)") # it works
xfun::find_locals("assign('y', x + 1, new.env())") # still smart
xfun::find_locals("eval(parse(text = 'y = x + 1'))") # no way
```

---

format\_bytes

*Format numbers of bytes using a specified unit*


---

**Description**

Call the S3 method `format.object_size()` to format numbers of bytes.

**Usage**

```
format_bytes(x, units = "auto", ...)
```

**Arguments**

`x` A numeric vector (each element represents a number of bytes).  
`units, ...` Passed to `format()`.

**Value**

A character vector.

**Examples**

```
xfun::format_bytes(c(1, 1024, 2000, 1e+06, 2e+08))
xfun::format_bytes(c(1, 1024, 2000, 1e+06, 2e+08), units = "KB")
```

---

from_root	<i>Get the relative path of a path in a project relative to the current working directory</i>
-----------	---

---

### Description

First compose an absolute path using the project root directory and the relative path components, i.e., `file.path(root, ...)`. Then convert it to a relative path with `relative_path()`, which is relative to the current working directory.

### Usage

```
from_root(..., root = proj_root(), error = TRUE)
```

### Arguments

...	A character vector of path components <i>relative to the root directory of the project</i> .
root	The root directory of the project.
error	Whether to signal an error if the path cannot be converted to a relative path.

### Details

This function was inspired by here: `here::here()`, and the major difference is that it returns a relative path by default, which is more portable.

### Value

A relative path, or an error when the project root directory cannot be determined or the conversion failed and `error = TRUE`.

### Examples

```
## Not run:  
xfun::from_root("data", "mtcars.csv")  
  
## End(Not run)
```

---

github_releases	<i>Get the tags of GitHub releases of a repository</i>
-----------------	--

---

### Description

Use the GitHub API (`github_api()`) to obtain the tags of the releases.

### Usage

```
github_releases(
  repo,
  tag = "",
  pattern = "v[0-9.]+",
  use_jsonlite = loadable("jsonlite")
)
```

### Arguments

repo	The repository name of the form user/repo, e.g., "yihui/xfun".
tag	A tag as a character string. If provided, it will be returned if the tag exists. If tag = "latest", the tag of the latest release is returned.
pattern	A regular expression to match the tags.
use_jsonlite	Whether to use <b>jsonlite</b> to parse the releases info.

### Value

A character vector of (GIT) tags.

### Examples

```
xfun::github_releases("yihui/xfun")
xfun::github_releases("gohugoio/hugo")
```

---

grep_sub	<i>Perform replacement with gsub() on elements matched from grep()</i>
----------	--

---

### Description

This function is a shorthand of `gsub(pattern, replacement, grep(pattern, x, value = TRUE))`.

### Usage

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

**Arguments**

pattern, replacement, x, ...  
 Passed to `grep()` and `gsub()`.

**Value**

A character vector.

**Examples**

```
# find elements that matches 'a[b]+c' and capitalize 'b' with perl regex
xfun::grep_sub("a([b]+)c", "a\\U\\1c", c("abc", "abbc", "addc", "123"), perl = TRUE)
```

---

<code>gsub_file</code>	<i>Search and replace strings in files</i>
------------------------	--

---

**Description**

These functions provide the "file" version of `gsub()`, i.e., they perform searching and replacement in files via `gsub()`.

**Usage**

```
gsub_file(file, ..., rw_error = TRUE)

gsub_files(files, ...)

gsub_dir(..., dir = ".", recursive = TRUE, ext = NULL, mimetype = ".*")

gsub_ext(ext, ..., dir = ".", recursive = TRUE)
```

**Arguments**

<code>file</code>	Path of a single file.
<code>...</code>	For <code>gsub_file()</code> , arguments passed to <code>gsub()</code> . For other functions, arguments passed to <code>gsub_file()</code> . Note that the argument <code>x</code> of <code>gsub()</code> is the content of the file.
<code>rw_error</code>	Whether to signal an error if the file cannot be read or written. If <code>FALSE</code> , the file will be ignored (with a warning).
<code>files</code>	A vector of file paths.
<code>dir</code>	Path to a directory (all files under this directory will be replaced).
<code>recursive</code>	Whether to find files recursively under a directory.
<code>ext</code>	A vector of filename extensions (without the leading periods).
<code>mimetype</code>	A regular expression to filter files based on their MIME types, e.g., <code> '^text/'</code> for plain text files.

**Note**

These functions perform in-place replacement, i.e., the files will be overwritten. Make sure you backup your files in advance, or use version control!

**Examples**

```
library(xfun)
f = tempfile()
writeLines(c("hello", "world"), f)
gsub_file(f, "world", "woRld", fixed = TRUE)
readLines(f)
```

---

html\_tag

*Tools for HTML tags*


---

**Description**

Given a tag name, generate an HTML tag with optional attributes and content. `html_tag()` can be viewed as a simplified version of `htmltools::tags`, `html_value()` adds classes on the value so that it will be treated as raw HTML (not escaped by `html_tag()`), `html_escape()` escapes special characters in HTML, and `html_view()` launches a browser or viewer to view the HTML content.

**Usage**

```
html_tag(.name, .content = NULL, .attrs = NULL, ...)
```

```
html_value(x)
```

```
html_escape(x, attr = FALSE)
```

```
html_view(x, ...)
```

**Arguments**

<code>.name</code>	The tag name.
<code>.content</code>	The content between opening and closing tags. Ignored for void tags such as <code>&lt;img&gt;</code> . Special characters such as <code>&amp;</code> , <code>&lt;</code> , and <code>&gt;</code> will be escaped unless the value was generated from <code>html_value()</code> . The content can be either a character vector or a list. If it is a list, it may contain both normal text and HTML content.
<code>.attrs</code>	A named list of attributes.
<code>...</code>	For <code>html_tag()</code> , named arguments as an alternative way to provide attributes. For <code>html_view()</code> , other arguments to be passed to <code>new_app()</code> .
<code>x</code>	A character vector to be treated as raw HTML content for <code>html_value()</code> , escaped for <code>html_escape()</code> , and viewed for <code>html_view()</code> .
<code>attr</code>	Whether to escape <code>"</code> , <code>\r</code> , and <code>\n</code> (which should be escaped for tag attributes).



**Value**

A character string.

**Examples**

```
xfun::html_tag("a", "<R Project>", href = "https://www.r-project.org", target = "_blank")
xfun::html_tag("br")
xfun::html_tag("a", xfun::html_tag("strong", "R Project"), href = "#")
xfun::html_tag("a", list("<text>", xfun::html_tag("b", "R Project")), href = "#")
xfun::html_escape("\ quotes \" & brackets < >")
xfun::html_escape("\ & < > \r \n", attr = TRUE)
```

---

install\_dir

*Install a source package from a directory*

---

**Description**

Run R CMD build to build a tarball from a source directory, and run R CMD INSTALL to install it.

**Usage**

```
install_dir(pkg, build = TRUE, build_opts = NULL, install_opts = NULL)
```

**Arguments**

pkg	The package source directory.
build	Whether to build a tarball from the source directory. If FALSE, run R CMD INSTALL on the directory directly (note that vignettes will not be automatically built).
build_opts	The options for R CMD build.
install_opts	The options for R CMD INSTALL.

**Value**

Invisible status from R CMD INSTALL.

---

install_github	<i>An alias of</i> <code>remotes::install_github()</code>
----------------	---

---

**Description**

This alias is to make autocomplete faster via `xfun::install_github`, because most `remotes::install_*` functions are never what I want. I only use `install_github` and it is inconvenient to autocomplete it, e.g. `install_git` always comes before `install_github`, but I never use it. In RStudio, I only need to type `xfun::ig` to get `xfun::install_github`.

**Usage**

```
install_github(...)
```

**Arguments**

... Arguments to be passed to `remotes::install_github()`.

---

in_dir	<i>Evaluate an expression under a specified working directory</i>
--------	---

---

**Description**

Change the working directory, evaluate the expression, and restore the working directory.

**Usage**

```
in_dir(dir, expr)
```

**Arguments**

<code>dir</code>	Path to a directory.
<code>expr</code>	An R expression.

**Examples**

```
library(xfun)
in_dir(tempdir(), {
  print(getwd())
  list.files()
})
```

---

is_abs_path	<i>Test if paths are relative or absolute</i>
-------------	---

---

**Description**

On Unix, check if the paths start with '/' or '~' (if they do, they are absolute paths). On Windows, check if a path remains the same (via [same\\_path\(\)](#)) if it is prepended with './' (if it does, it is a relative path).

**Usage**

```
is_abs_path(x)
```

```
is_rel_path(x)
```

**Arguments**

x                   A vector of paths.

**Value**

A logical vector.

**Examples**

```
xfun::is_abs_path(c("C:/foo", "foo.txt", "/Users/john/", tempdir()))  
xfun::is_rel_path(c("C:/foo", "foo.txt", "/Users/john/", tempdir()))
```

---

is_ascii	<i>Check if a character vector consists of entirely ASCII characters</i>
----------	--

---

**Description**

Converts the encoding of a character vector to 'ascii', and check if the result is NA.

**Usage**

```
is_ascii(x)
```

**Arguments**

x                   A character vector.

**Value**

A logical vector indicating whether each element of the character vector is ASCII.

**Examples**

```
library(xfun)
is_ascii(letters) # yes
is_ascii(intToUtf8(8212)) # no
```

---

is_blank	<i>Test if a character vector consists of blank strings</i>
----------	---

---

**Description**

Return a logical vector indicating if elements of a character vector are blank (white spaces or empty strings).

**Usage**

```
is_blank(x)
```

**Arguments**

x                    A character vector.

**Value**

TRUE for blank elements, or FALSE otherwise.

**Examples**

```
xfun::is_blank("")
xfun::is_blank("abc")
xfun::is_blank(c("", " ", "\n\t"))
xfun::is_blank(c("", " ", "abc"))
```

---

is_sub_path	<i>Test if a path is a subpath of a dir</i>
-------------	---

---

**Description**

Check if the path starts with the dir path.

**Usage**

```
is_sub_path(x, dir, n = nchar(dir))
```

**Arguments**

x                    A vector of paths.  
 dir                  A vector of directory paths.  
 n                    The length of dir paths.

**Value**

A logical vector.

**Note**

You may want to normalize the values of the x and dir arguments first (with `normalize_path()`), to make sure the path separators are consistent.

**Examples**

```
xfun::is_sub_path("a/b/c.txt", "a/b") # TRUE
xfun::is_sub_path("a/b/c.txt", "d/b") # FALSE
xfun::is_sub_path("a/b/c.txt", "a\\b") # FALSE (even on Windows)
```

---

is_web_path	<i>Test if a path is a web path</i>
-------------	-------------------------------------

---

**Description**

Check if a path starts with 'http://' or 'https://' or 'ftp://' or 'ftps://'.

**Usage**

```
is_web_path(x)
```

**Arguments**

x                    A vector of paths.

**Value**

A logical vector.

**Examples**

```
xfun::is_web_path("https://www.r-project.org") # TRUE
xfun::is_web_path("www.r-project.org") # FALSE
```

---

is_windows	<i>Test for types of operating systems</i>
------------	--

---

**Description**

Functions based on `.Platform$OS.type` and `Sys.info()` to test if the current operating system is Windows, macOS, Unix, or Linux.

**Usage**

```
is_windows()
is_unix()
is_macos()
is_linux()
is_arm64()
```

**Examples**

```
library(xfun)
# only one of the following statements should be true
is_windows()
is_unix() && is_macos()
is_linux()
# In newer Macs, CPU can be either Intel or Apple
is_arm64() # TRUE on Apple silicone machines
```

---

join_words	<i>Join multiple words into a single string</i>
------------	---

---

**Description**

If `words` is of length 2, the first word and second word are joined by the `and` string; if `and` is blank, `sep` is used. When the length is greater than 2, `sep` is used to separate all words, and the `and` string is prepended to the last word.

**Usage**

```
join_words(
  words,
  sep = ", ",
  and = " and ",
  before = "",
```

```

    after = before,
    oxford_comma = TRUE
  )

```

### Arguments

words	A character vector.
sep	Separator to be inserted between words.
and	Character string to be prepended to the last word.
before, after	A character string to be added before/after each word.
oxford_comma	Whether to insert the separator between the last two elements in the list.

### Value

A character string marked by `raw_string()`.

### Examples

```

join_words("a")
join_words(c("a", "b"))
join_words(c("a", "b", "c"))
join_words(c("a", "b", "c"), sep = " / ", and = "")
join_words(c("a", "b", "c"), and = "")
join_words(c("a", "b", "c"), before = "\"", after = "\"")
join_words(c("a", "b", "c"), before = "\"", after = "\"", oxford_comma = FALSE)

```

---

lazy_save	<i>Save objects to files and lazy-load them</i>
-----------	---

---

### Description

The function `lazy_save()` saves objects to files with incremental integer names (e.g., the first object is saved to `1.rds`, and the second object is saved to `2.rds`, etc.). The function `lazy_load()` lazy-load objects from files saved via `lazy_save()`, i.e., a file will not be read until the object is used.

### Usage

```

lazy_save(list = NULL, path = "./", method = "auto", envir = parent.frame())

lazy_load(path = "./", method = "auto", envir = parent.frame())

```

**Arguments**

list	A character vector of object names. This list will be written to an index file with <code>0</code> as the base name (e.g., <code>0.rds</code> ).
path	The path to write files to / read files from.
method	The file save/load method. It can be a string (e.g., <code>rds</code> , <code>raw</code> , or <code>qs</code> ) or a list. See the <code>rw</code> argument of <code>cache_exec()</code> . By default, it is automatically detected by checking the existence of the index file (e.g., <code>0.rds</code> , <code>0.raw</code> , or <code>0.qs</code> ).
envir	The environment to <code>get</code> or <code>assign</code> objects.

**Value**

`lazy_save()` returns invisible `NULL`; `lazy_load()` returns the object names invisibly.

**See Also**

`delayedAssign()`

---

magic_path	<i>Find a file or directory under a root directory</i>
------------	--

---

**Description**

Given a path, try to find it recursively under a root directory. The input path can be an incomplete path, e.g., it can be a base filename, and `magic_path()` will try to find this file under subdirectories.

**Usage**

```
magic_path(
  ...,
  root = proj_root(),
  relative = TRUE,
  error = TRUE,
  message = getOption("xfun.magic_path.message", TRUE),
  n_dirs = getOption("xfun.magic_path.n_dirs", 10000)
)
```

**Arguments**

...	A character vector of path components.
root	The root directory under which to search for the path. If <code>NULL</code> , the current working directory is used.
relative	Whether to return a relative path.
error	Whether to signal an error if the path is not found, or multiple paths are found.
message	Whether to emit a message when multiple paths are found and <code>error = FALSE</code> .



`n_dirs`            The number of subdirectories to recursively search. The recursive search may be time-consuming when there are a large number of subdirectories under the root directory. If you really want to search for all subdirectories, you may try `n_dirs = Inf`.

### Value

The path found under the root directory, or an error when `error = TRUE` and the path is not found (or multiple paths are found).

### Examples

```
## Not run:
xfun::magic_path("mtcars.csv") # find any file that has the base name mtcars.csv

## End(Not run)
```

---

mark_dirs	<i>Mark some paths as directories</i>
-----------	---------------------------------------

---

### Description

Add a trailing backlash to a file path if this is a directory. This is useful in messages to the console for example to quickly identify directories from files.

### Usage

```
mark_dirs(x)
```

### Arguments

`x`                    Character vector of paths to files and directories.

### Details

If `x` is a vector of relative paths, directory test is done with path relative to the current working dir. Use [in\\_dir\(\)](#) or use absolute paths.

### Examples

```
mark_dirs(list.files(find.package("xfun"), full.names = TRUE))
```

---

md5	<i>Calculate the MD5 checksums of R objects</i>
-----	---

---

**Description**

[Serialize](#) an object and calculate the checksum via `tools::md5sum()`. If `tools::md5sum()` does not have the argument `bytes`, the object will be first serialized to a temporary file, which will be deleted after the checksum is calculated, otherwise the raw bytes of the object will be passed to the `bytes` argument directly (which will be faster than writing to a temporary file).

**Usage**

```
md5(...)
```

**Arguments**

... Any number of R objects.

**Value**

A character vector of the checksums of objects passed to `md5()`. If the arguments are named, the results will also be named.

**Examples**

```
x1 = 1
x2 = 1:10
x3 = seq(1, 10)
x4 = iris
x5 = paste
(m = xfun::md5(x1, x2, x3, x4, x5))
stopifnot(m[2] == m[3]) # x2 and x3 should be identical

xfun::md5(x1 = x1, x2 = x2) # named arguments
```

---

md_table	<i>Generate a simple Markdown pipe table</i>
----------	--

---

**Description**

A minimal Markdown table generator using the pipe `|` as column separators.

**Usage**

```
md_table(x, digits = NULL, na = NULL, newline = NULL, limit = NULL)
```

**Arguments**

<code>x</code>	A 2-dimensional object (e.g., a matrix or data frame).
<code>digits</code>	The number of decimal places to be passed to <code>round()</code> . It can be a integer vector of the same length as the number of columns in <code>x</code> to round columns separately. The default is 3.
<code>na</code>	A character string to represent NA values. The default is an empty string.
<code>newline</code>	A character string to substitute <code>\n</code> in <code>x</code> (because pipe tables do not support line breaks in cells). The default is a space.
<code>limit</code>	The maximum number of rows to show in the table. If it is smaller than the number of rows, the data in the middle will be omitted. If it is of length 2, the second number will be used to limit the number of columns. Zero and negative values are ignored.

**Details**

The default argument values can be set via global options with the prefix `xfun.md_table.`, e.g., `options(xfun.md_table.digits 2, xfun.md_table.na = 'n/a')`.

**Value**

A character vector.

**See Also**

`knitr::kable()` (which supports more features)

**Examples**

```
xfun::md_table(head(iris))
xfun::md_table(mtcars, limit = c(10, 6))
```

---

mime\_type

*Get the MIME types of files*

---

**Description**

If the **mime** package is installed, call `mime::guess_type()`, otherwise use the system command `file --mime-type` to obtain the MIME type of a file. Typically, the `file` command exists on \*nix. On Windows, the command should exist if Cygwin or Rtools is installed. If it is not found, .NET's MimeMapping class will be used instead (which requires the .NET framework).

**Usage**

```
mime_type(x, use_mime = loadable("mime"), empty = "text/plain")
```

**Arguments**

x	A vector of file paths.
use_mime	Whether to use the <b>mime</b> package.
empty	The MIME type for files without extensions (e.g., Makefile). If NA, the type will be obtained from system command. This argument is used only for use_mime = FALSE.

**Value**

A character vector of MIME types.

**Note**

When querying the MIME type via the system command, the result will be cached to `xfun:::cache_dir()`. This will make future queries much faster, since running the command in real time can be a little slow.

**Examples**

```
f = list.files(R.home("doc"), full.names = TRUE)
mime_type(f)
mime_type(f, FALSE) # don't use mime
mime_type(f, FALSE, NA) # run command for files without extension
```

---

msg\_cat

*Generate a message with cat()*

---

**Description**

This function is similar to `message()`, and the difference is that `msg_cat()` uses `cat()` to write out the message, which is sent to `stdout()` instead of `stderr()`. The message can be suppressed by `suppressMessages()`.

**Usage**

```
msg_cat(...)
```

**Arguments**

...	Character strings of messages, which will be concatenated into one string via <code>paste(c(...), collapse = '')</code> .
-----	---

**Value**

Invisible NULL, with the side-effect of printing the message.

**Note**

By default, a newline will not be appended to the message. If you need a newline, you have to explicitly add it to the message (see 'Examples').

**See Also**

This function was inspired by `rlang::inform()`.

**Examples**

```
{
  # a message without a newline at the end
  xfun::msg_cat("Hello world!")
  # add a newline at the end
  xfun::msg_cat(" This message appears right after the previous one.\n")
}
suppressMessages(xfun::msg_cat("Hello world!"))
```

---

`native_encode`*Try to use the system native encoding to represent a character vector*

---

**Description**

Apply `enc2native()` to the character vector, and check if `enc2utf8()` can convert it back without a loss. If it does, return `enc2native(x)`, otherwise return the original vector with a warning.

**Usage**

```
native_encode(x)
```

**Arguments**

`x` A character vector.

**Note**

On platforms that supports UTF-8 as the native encoding (`l10n_info()[['UTF-8']]` returns TRUE), the conversion will be skipped.

**Examples**

```
library(xfun)
s = intToUtf8(c(20320, 22909))
Encoding(s)

s2 = native_encode(s)
Encoding(s2)
```

---

news2md	<i>Convert package news to the Markdown format</i>
---------	--

---

**Description**

Read the package news with `news()`, convert the result to Markdown, and write to an output file (e.g., 'NEWS.md'). Each package version appears in a first-level header, each category (e.g., 'NEW FEATURES' or 'BUG FIXES') is in a second-level header, and the news items are written into bullet lists.

**Usage**

```
news2md(package, ..., output = "NEWS.md", category = TRUE)
```

**Arguments**

package, ...	Arguments to be passed to <code>news()</code> .
output	The output file path.
category	Whether to keep the category names.

**Value**

If `output = NA`, returns the Markdown content as a character vector, otherwise the content is written to the output file.

**Examples**

```
# news for the current version of R
xfun::news2md("R", Version == getRversion(), output = NA)
```

---

new_app	<i>Create a local web application</i>
---------	---------------------------------------

---

**Description**

An experimental function to create a local web application based on R's internal httpd server (which is primarily for running R's dynamic help system).

**Usage**

```
new_app(name, handler, open = interactive(), ports = 4321 + 1:10)
```

**Arguments**

name	The app name (a character string, and each app should have a unique name).
handler	A function that takes the HTTP request information (the first argument is the requested path) and returns a response.
open	Whether to open the app, or a function to open the app URL.
ports	A vector of ports to try for starting the server.

**Value**

The app URL of the form `http://127.0.0.1:port/custom/name/`.

**Note**

This function is not based on base R's public API, and is possible to break in the future, which is also why the documentation here is terse. Please avoid creating public-facing web apps with it. You may consider packages like **httpuv** and **Rserve** for production web apps.

---

normalize_path	<i>Normalize paths</i>
----------------	------------------------

---

**Description**

A wrapper function of `normalizePath()` with different defaults.

**Usage**

```
normalize_path(x, winslash = "/", must_work = FALSE, resolve_symlink = TRUE)
```

**Arguments**

x, winslash, must_work	Arguments passed to <code>normalizePath()</code> .
resolve_symlink	Whether to resolve symbolic links.

**Examples**

```
library(xfun)
normalize_path("~/")
```

---

numbers\_to\_words      *Convert numbers to English words*

---

### Description

This can be helpful when writing reports with **knitr/rmarkdown** if we want to print numbers as English words in the output. The function `n2w()` is an alias of `numbers_to_words()`.

### Usage

```
numbers_to_words(x, cap = FALSE, hyphen = TRUE, and = FALSE)
```

```
n2w(x, cap = FALSE, hyphen = TRUE, and = FALSE)
```

### Arguments

<code>x</code>	A numeric vector. The absolute values should be less than $1e15$ .
<code>cap</code>	Whether to capitalize the first letter of the word. This can be useful when the word is at the beginning of a sentence. Default is <code>FALSE</code> .
<code>hyphen</code>	Whether to insert hyphen (-) when the number is between 21 and 99 (except 30, 40, etc.).
<code>and</code>	Whether to insert and between hundreds and tens, e.g., write 110 as “one hundred and ten” if <code>TRUE</code> instead of “one hundred ten”.

### Value

A character vector.

### Author(s)

Daijiang Li

### Examples

```
library(xfun)
n2w(0, cap = TRUE)
n2w(0:121, and = TRUE)
n2w(1e+06)
n2w(1e+11 + 12345678)
n2w(-987654321)
n2w(1e+15 - 1)
n2w(123.456)
n2w(123.45678901)
n2w(123.456789098765)
```



---

optipng	<i>Run OptiPNG on all PNG files under a directory</i>
---------	---

---

**Description**

Call the command `optipng` via `system2()` to optimize all PNG files under a directory.

**Usage**

```
optipng(dir = ".", files = all_files("[.]png$", dir), ...)
```

**Arguments**

<code>dir</code>	Path to a directory.
<code>files</code>	Alternatively, you can choose the specific files to optimize.
<code>...</code>	Arguments to be passed to <code>system2()</code> .

**References**

OptiPNG: <https://optipng.sourceforge.net>.

---

<code>parse_only</code>	<i>Parse R code and do not keep the source</i>
-------------------------	--

---

**Description**

An abbreviation of `parse(keep.source = FALSE)`.

**Usage**

```
parse_only(code)
```

**Arguments**

<code>code</code>	A character vector of the R source code.
-------------------	--

**Value**

R `expression()`s.

**Examples**

```
library(xfun)
parse_only("1+1")
parse_only(c("y~x", "1:5 # a comment"))
parse_only(character(0))
```

---

pkg_attach	<i>Attach or load packages, and automatically install missing packages if requested</i>
------------	---

---

## Description

pkg\_attach() is a vectorized version of `library()` over the package argument to attach multiple packages in a single function call. pkg\_load() is a vectorized version of `requireNamespace()` to load packages (without attaching them). The functions `pkg_attach2()` and `pkg_load2()` are wrappers of `pkg_attach(install = TRUE)` and `pkg_load(install = TRUE)`, respectively. `loadable()` is an abbreviation of `requireNamespace(quietly = TRUE)`. `pkg_available()` tests if a package with a minimal version is available.

## Usage

```
pkg_attach(
  ...,
  install = FALSE,
  message = getOption("xfun.pkg_attach.message", TRUE)
)
```

```
pkg_load(..., error = TRUE, install = FALSE)
```

```
loadable(pkg, strict = TRUE, new_session = FALSE)
```

```
pkg_available(pkg, version = NULL)
```

```
pkg_attach2(...)
```

```
pkg_load2(...)
```

## Arguments

...	Package names (character vectors, and must always be quoted).
install	Whether to automatically install packages that are not available using <code>install.packages()</code> . Besides TRUE and FALSE, the value of this argument can also be a function to install packages ( <code>install = TRUE</code> is equivalent to <code>install = install.packages</code> ), or a character string "pak" (equivalent to <code>install = pak::pkg_install</code> , which requires the <b>pak</b> package). You are recommended to set a CRAN mirror in the global option <code>repos</code> via <code>options()</code> if you want to automatically install packages.
message	Whether to show the package startup messages (if any startup messages are provided in a package).
error	Whether to signal an error when certain packages cannot be loaded.
pkg	A single package name.

strict	If TRUE, use <code>requireNamespace()</code> to test if a package is loadable; otherwise only check if the package is in <code>.packages(TRUE)</code> (this does not really load the package, so it is less rigorous but on the other hand, it can keep the current R session clean).
new_session	Whether to test if a package is loadable in a new R session. Note that <code>new_session = TRUE</code> implies <code>strict = TRUE</code> .
version	A minimal version number. If NULL, only test if a package is available and do not check its version.

### Details

These are convenience functions that aim to solve these common problems: (1) We often need to attach or load multiple packages, and it is tedious to type several `library()` calls; (2) We are likely to want to install the packages when attaching/loading them but they have not been installed.

### Value

`pkg_attach()` returns NULL invisibly. `pkg_load()` returns a logical vector, indicating whether the packages can be loaded.

### See Also

`pkg_attach2()` is similar to `pacman::p_load()`, but does not allow non-standard evaluation (NSE) of the `...` argument, i.e., you must pass a real character vector of package names to it, and all names must be quoted. Allowing NSE adds too much complexity with too little gain (the only gain is that it saves your effort in typing two quotes).

### Examples

```
library(xfun)
pkg_attach("stats", "graphics")
# pkg_attach2('servr') # automatically install servr if it is not installed

(pkg_load("stats", "graphics"))
```

### Description

Call `utils::citation()` and `utils::toBibtex()` to create bib entries for R packages and write them in a file. It can facilitate the auto-generation of bibliography databases for R packages, and it is easy to regenerate all the citations after updating R packages.

**Usage**

```
pkg_bib(
  x = .packages(),
  file = "",
  tweak = TRUE,
  width = NULL,
  prefix = getOption("xfun.bib.prefix", "R-"),
  lib.loc = NULL,
  packageURL = TRUE
)
```

**Arguments**

x	Package names. Packages which are not installed are ignored.
file	The (‘.bib’) file to write. By default, or if NULL, output is written to the R console.
tweak	Whether to fix some known problems in the citations, especially non-standard format of author names.
width	Width of lines in bibliography entries. If NULL, lines will not be wrapped.
prefix	Prefix string for keys in BibTeX entries; by default, it is R- unless option(‘xfun.bib.prefix’) has been set to another string.
lib.loc	A vector of path names of R libraries.
packageURL	Use the URL field from the ‘DESCRIPTION’ file. See Details below.

**Details**

For a package, the keyword R-pkgname is used for its bib item, where pkgname is the name of the package. Citation entries specified in the ‘CITATION’ file of the package are also included. The main purpose of this function is to automate the generation of the package citation information because it often changes (e.g., the author, year, package version, and so on).

There are at least two different uses for the URL in a reference list. You might want to tell users where to go for more information. In that case, use the default packageURL = TRUE, and the first URL listed in the ‘DESCRIPTION’ file will be used. Be careful: some authors don’t put the most relevant URL first. Alternatively, you might want to identify exactly which version of the package was used in the document. If it was installed from CRAN or some other repositories, the version number identifies it, and packageURL = FALSE will use the repository URL (as used by `utils::citation()`).

**Value**

A list containing the citations. Citations are also written to the file as a side effect.

**Note**

Some packages on CRAN do not have standard bib entries, which was once reported by Michael Friendly at <https://stat.ethz.ch/pipermail/r-devel/2010-November/058977.html>. I find

this a pain, and there are no easy solutions except contacting package authors to modify their DESCRIPTION files. The argument `tweak` has provided hacks to deal with known packages with non-standard bib entries; `tweak = TRUE` is by no means intended to hide or modify the original citation information. It is just due to the loose requirements on package authors for the DESCRIPTION file. On one hand, I apologize if it really mangles the information about certain packages; on the other, I strongly recommend package authors to consider the `Authors@R` field (see the manual *Writing R Extensions*) to make it easier for other people to cite R packages.

### Author(s)

Yihui Xie and Michael Friendly

### Examples

```
pkg_bib(c("base", "MASS", "xfun"))
pkg_bib("cluster", prefix = "R-pkg-") # a different prefix
```

---

process_file	<i>Read a text file, process the text with a function, and write the text back</i>
--------------	--

---

### Description

Read a text file with the UTF-8 encoding, apply a function to the text, and write back to the original file if the processed text is different with the original input.

### Usage

```
process_file(file, fun = identity, x = read_utf8(file))

sort_file(..., fun = sort)
```

### Arguments

<code>file</code>	Path to a text file.
<code>fun</code>	A function to process the text.
<code>x</code>	The content of the file.
<code>...</code>	Arguments to be passed to <code>process_file()</code> .

### Details

`sort_file()` is an application of `process_file()`, with the processing function being `sort()`, i.e., it sorts the text lines in a file and write back the sorted text.

### Value

If `file` is provided, invisible NULL (the file is updated as a side effect), otherwise the processed content (as a character vector).

**Examples**

```
f = tempfile()
xfun::write_utf8("Hello World", f)
xfun::process_file(f, function(x) gsub("World", "woRld", x))
xfun::read_utf8(f) # see if it has been updated
file.remove(f)
```

---

`proc_kill`                      *Kill a process and (optionally) all its child processes*

---

**Description**

Run the command `taskkill /f /pid` on Windows and `kill` on Unix, respectively, to kill a process.

**Usage**

```
proc_kill(pid, recursive = TRUE, ...)
```

**Arguments**

<code>pid</code>	The process ID.
<code>recursive</code>	Whether to kill the child processes of the process.
<code>...</code>	Arguments to be passed to <code>system2()</code> to run the command to kill the process.

**Value**

The status code returned from `system2()`.

---

`proj_root`                      *Return the (possible) root directory of a project*

---

**Description**

Given a path of a file (or dir) in a potential project (e.g., an R package or an RStudio project), return the path to the project root directory.

**Usage**

```
proj_root(path = "./", rules = root_rules)

root_rules
```

**Arguments**

path	The initial path to start the search. If it is a file path, its parent directory will be used.
rules	A matrix of character strings of two columns: the first column contains regular expressions to look for filenames that match the patterns, and the second column contains regular expressions to match the content of the matched files. The regular expression can be an empty string, meaning that it will match anything.

**Format**

An object of class `matrix` (inherits from `array`) with 2 rows and 2 columns.

**Details**

The search for the root directory is performed by a series of tests, currently including looking for a 'DESCRIPTION' file that contains `Package: *` (which usually indicates an R package), and a '\*.Rproj' file that contains `Version: *` (which usually indicates an RStudio project). If files with the expected patterns are not found in the initial directory, the search will be performed recursively in upper-level directories.

**Value**

Path to the root directory if found, otherwise `NULL`.

**Note**

This function was inspired by the **rprojroot** package, but is much less sophisticated. It is a rather simple function designed to be used in some of packages that I maintain, and may not meet the need of general users until this note is removed in the future (which should be unlikely). If you are sure that you are working on the types of projects mentioned in the 'Details' section, this function may be helpful to you, otherwise please consider using **rprojroot** instead.

---

prose\_index                      *Find the indices of lines in Markdown that are prose (not code blocks)*

---

**Description**

Filter out the indices of lines between code block fences such as ````` (could be three or four or more backticks).

**Usage**

```
prose_index(x, warn = TRUE)
```

**Arguments**

x	A character vector of text in Markdown.
warn	Whether to emit a warning when code fences are not balanced.

**Value**

An integer vector of indices of lines that are prose in Markdown.

**Note**

If the code fences are not balanced (e.g., a starting fence without an ending fence), this function will treat all lines as prose.

**Examples**

```
library(xfun)
prose_index(c("a", "``", "b", "``", "c"))
prose_index(c("a", "``", "``r", "1+1", "``", "``", "c"))
```

---

protect\_math

*Protect math expressions in pairs of backticks in Markdown*

---

**Description**

For Markdown renderers that do not support LaTeX math, we need to protect math expressions as verbatim code (in a pair of backticks), because some characters in the math expressions may be interpreted as Markdown syntax (e.g., a pair of underscores may make text italic). This function detects math expressions in Markdown (by heuristics), and wrap them in backticks.

**Usage**

```
protect_math(x, token = "", use_block = FALSE)
```

**Arguments**

x	A character vector of text in Markdown.
token	A character string to wrap math expressions at both ends. This can be a unique token so that math expressions can be reliably identified and restored after the Markdown text is converted.
use_block	Whether to use code blocks ( <code>``md-math</code> ) to protect <code>\$\$</code> <code>\$\$</code> expressions that span across multiple lines. This is necessary when a certain line in the math expression starts with a special character that can accidentally start a new element (e.g., a leading <code>+</code> may start a bullet list). Only code blocks can prevent this case.

**Details**

Expressions in pairs of dollar signs or double dollar signs are treated as math, if there are no spaces after the starting dollar sign, or before the ending dollar sign. There should be a space or `(` before the starting dollar sign, unless the math expression starts from the very beginning of a line. For a pair of single dollar signs, the ending dollar sign should not be followed by a number, and the inner math expression should not be wrapped in backticks. With these assumptions, there should not be too many false positives when detecting math expressions.

Besides, LaTeX environments (`\begin{*}` and `\end{*}`) are also protected in backticks.



**Value**

A character vector with math expressions in backticks.

**Note**

If you are using Pandoc or the **rmarkdown** package, there is no need to use this function, because Pandoc's Markdown can recognize math expressions.

**Examples**

```
library(xfun)
protect_math(c("hi $a+b$", "hello $$\\alpha$$", "no math here: $x is $10 dollars"))
protect_math(c("hi $$", "\\begin{equation}", "x + y = z", "\\end{equation}"))
protect_math("$a+b$", "===")
```

---

raw\_string

---

*Print a character vector in its raw form*


---

**Description**

The function `raw_string()` assigns the class `xfun_raw_string` to the character vector, and the corresponding printing function `print.xfun_raw_string()` uses `cat(x, sep = '\n')` to write the character vector to the console, which will suppress the leading indices (such as `[1]`) and double quotes, and it may be easier to read the characters in the raw form (especially when there are escape sequences).

**Usage**

```
raw_string(x)

## S3 method for class 'xfun_raw_string'
print(x, ...)
```

**Arguments**

<code>x</code>	For <code>raw_string()</code> , a character vector. For the print method, the <code>raw_string()</code> object.
<code>...</code>	Other arguments (currently ignored).

**Examples**

```
library(xfun)
raw_string(head(LETTERS))
raw_string(c("a \"b\"", "hello\tworld!"))
```

---

read_all	<i>Read all text files and concatenate their content</i>
----------	--

---

### Description

Read files one by one, and optionally add text before/after the content. Then combine all content into one character vector.

### Usage

```
read_all(files, before = function(f, x) NULL, after = function(f, x) NULL)
```

### Arguments

files	A vector of file paths.
before, after	A function that takes one file path and its content as the input and returns values to be added before or after the content of the file. Alternatively, they can be constant values to be added.

### Value

A character vector.

### Examples

```
# two files in this package
fs = system.file("scripts", c("call-fun.R", "child-pids.sh"), package = "xfun")
xfun::read_all(fs)

# add file paths before file content and an empty line after content
xfun::read_all(fs, before = function(f) paste("#-----", f, "-----"), after = "")

# add constants
xfun::read_all(fs, before = "/*", after = c("*/", ""))
```

---

read_bin	<i>Read all records of a binary file as a raw vector by default</i>
----------	---

---

### Description

This is a wrapper function of `readBin()` with default arguments `what = "raw"` and `n = file.size(file)`, which means it will read the full content of a binary file as a raw vector by default.

### Usage

```
read_bin(file, what = "raw", n = file.info(file)$size, ...)
```

**Arguments**

file, what, n, ...  
 Arguments to be passed to readBin().

**Value**

A vector returned from readBin().

**Examples**

```
f = tempfile()
cat("abc", file = f)
xfun::read_bin(f)
unlink(f)
```

---

read_utf8	<i>Read / write files encoded in UTF-8</i>
-----------	--

---

**Description**

Read or write files, assuming they are encoded in UTF-8. read\_utf8() is roughly readLines(encoding = 'UTF-8') (a warning will be issued if non-UTF8 lines are found), and write\_utf8() calls writeLines(enc2utf8(text), useBytes = TRUE).

**Usage**

```
read_utf8(con, error = FALSE)

write_utf8(text, con, ...)

append_utf8(text, con, sort = TRUE)

append_unique(text, con, sort = function(x) base::sort(unique(x)))
```

**Arguments**

con	A connection or a file path.
error	Whether to signal an error when non-UTF8 characters are detected (if FALSE, only a warning message is issued).
text	A character vector (will be converted to UTF-8 via <code>enc2utf8()</code> ).
...	Other arguments passed to <code>writeLines()</code> (except <code>useBytes</code> , which is TRUE in <code>write_utf8()</code> ).
sort	Logical (FALSE means not to sort the content) or a function to sort the content; TRUE is equivalent to <code>base::sort</code> .

**Details**

The function `append_utf8()` appends UTF-8 content to a file or connection based on `read_utf8()` and `write_utf8()`, and optionally sort the content. The function `append_unique()` appends unique lines to a file or connection.

**Value**

`read_utf8()` returns a character vector of the file content; `write_utf8()` returns the `con` argument (invisibly).

---

 record

*Run R code and record the results*


---

**Description**

Run R code and capture various types of output, including text output, plots, messages, warnings, and errors.

**Usage**

```
record(
  code = NULL,
  dev = "png",
  dev.path = "xfun-record",
  dev.ext = dev_ext(dev),
  dev.args = list(),
  message = TRUE,
  warning = TRUE,
  error = NA,
  cache = list(),
  print = record_print,
  print.args = list(),
  verbose = getOption("xfun.record.verbose", 0),
  envir = parent.frame()
)

## S3 method for class 'xfun_record_results'
format(
  x,
  to = c("text", "markdown", "html"),
  encode = FALSE,
  template = FALSE,
  ...
)

## S3 method for class 'xfun_record_results'
print(
```

```

x,
browse = interactive(),
to = if (browse) "html" else "text",
template = TRUE,
...
)

```

## Arguments

code	A character vector of R source code.
dev	A graphics device. It can be a function name, a function, or a character string that can be evaluated to a function to open a graphics device.
dev.path	A base file path for plots. Actual plot filenames will be this base path plus incremental suffixes. For example, if <code>dev.path = "foo"</code> , the plot files will be <code>foo-1.png</code> , <code>foo-2.png</code> , and so on. If <code>dev.path</code> is not character (e.g., <code>FALSE</code> ), plots will not be recorded.
dev.ext	The file extension for plot files. By default, it will be inferred from the first argument of the device function if possible.
dev.args	Extra arguments to be passed to the device. The default arguments are <code>list(units = 'in', onefile = FALSE, width = 7, height = 7, res = 96)</code> . If any of these arguments is not present in the device function, it will be dropped.
message, warning, error	If <code>TRUE</code> , record and store messages / warnings / errors in the output. If <code>FALSE</code> , suppress them. If <code>NA</code> , do not process them (messages will be emitted to the console, and errors will halt the execution).
cache	A list of options for caching. See the <code>path</code> , <code>id</code> , and <code>...</code> arguments of <code>cache_exec()</code> .
print	A (typically S3) function that takes the value of an expression in the code as input and returns output. The default is <code>record_print()</code> . If a non-function value (e.g., <code>NA</code> ) is passed to this argument, <code>print()</code> (or <code>show()</code> for S4 objects) will be used.
print.args	A list of arguments for the print function. By default, the whole list is not passed directly to the function, but only an element in the list with a name identical to the first class name of the returned value of the expression, e.g., <code>list(data.frame = list(digits = 3), matrix = list())</code> . This makes it possible to apply different print arguments to objects of different classes. If the whole list is intended to be passed to the print function directly, wrap the list in <code>I()</code> .
verbose	2 means to always print the value of each expression in the code, no matter if the value is <code>invisible()</code> or not; 1 means to always print the value of the last expression; 0 means no special handling (i.e., print only when the value is visible).
envir	An environment in which the code is evaluated.
x	An object returned by <code>record()</code> .
to	The output format (text, markdown, or html).
encode	For HTML output, whether to base64 encode plots.

template	For HTML output, whether to embed the formatted results in an HTML template. Alternatively, this argument can take a file path, i.e., path to an HTML template that contains the variable <code>\$body\$</code> . If TRUE, the default template in this package will be used ( <code>xfun::pkg_file('resources', 'record.html')</code> ).
...	Currently ignored.
browse	Whether to browse the results on an HTML page.

## Value

`record()` returns a list of the class `xfun_record_results` that contains elements with these possible classes: `record_source` (source code), `record_output` (text output), `record_plot` (plot file paths), `record_message` (messages), `record_warning` (warnings), and `record_error` (errors, only when the argument `error = TRUE`).

The `format()` method returns a character vector of plain-text output or HTML code for displaying the results.

The `print()` method prints the results as plain text or HTML to the console or displays the HTML page.

## Examples

```
code = c("# a warning test", "1:2 + 1:3", "par(mar = c(4, 4, 1, .2))",
  "barplot(5:1, col = 2:6, horiz = TRUE)", "head(iris)",
  "sunflowerplot(iris[, 3:4], seg.col = 'purple')",
  "if (TRUE) {\n  message('Hello, xfun::record()!')\n}",
  "# throw an error", "1 + 'a'")
res = xfun::record(code, dev.args = list(width = 9, height = 6.75),
  error = TRUE)
xfun::tree(res)
format(res)
# find and clean up plot files
plots = Filter(function(x) inherits(x, "record_plot"),
  res)
file.remove(unlist(plots))
```

---

record\_print

*Print methods for record()*

---

## Description

An S3 generic function to be called to print visible values in code when the code is recorded by `record()`. It is similar to `knitr::knit_print()`. By default, it captures the normal `print()` output and returns the result as a character vector. The `knitr_kable` method is for printing `knitr::kable()` output. Users and package authors can define other S3 methods to extend this function.

**Usage**

```
record_print(x, ...)

## Default S3 method:
record_print(x, ...)

## S3 method for class 'record_asis'
record_print(x, ...)

new_record(x, class)
```

**Arguments**

`x` For `record_print()`, the value to be printed. For `new_record()`, a character vector to be included in the printed results.

`...` Other arguments to be passed to `record_print()` methods.

`class` A class name. Possible values are `xfun:::record_cls`.

**Value**

A `record_print()` method should return a character vector or a list of character vectors. The original classes of the vector will be discarded, and the vector will be treated as console output by default (i.e., `new_record(class = "output")`). If it should be another type of output, wrap the vector in `new_record()` and specify a class name.

---

relative_path	<i>Get the relative path of a path relative to a directory</i>
---------------	--

---

**Description**

Given a directory, return the relative path that is relative to this directory. For example, the path `'foo/bar.txt'` relative to the directory `'foo/'` is `'bar.txt'`, and the path `'/a/b/c.txt'` relative to `'/d/e/'` is `'../..a/b/c.txt'`.

**Usage**

```
relative_path(x, dir = ".", use.. = TRUE, error = TRUE)
```

**Arguments**

`x` A vector of paths to be converted to relative paths.

`dir` Path to a directory.

`use..` Whether to use double-dots (`'..'`) in the relative path. A double-dot indicates the parent directory (starting from the directory provided by the `dir` argument).

`error` Whether to signal an error if a path cannot be converted to a relative path.

**Value**

A vector of relative paths if the conversion succeeded; otherwise the original paths when `error = FALSE`, and an error when `error = TRUE`.

**Examples**

```
xfun::relative_path("foo/bar.txt", "foo/")
xfun::relative_path("foo/bar/a.txt", "foo/haha/")
xfun::relative_path(getwd())
```

---

 rename\_seq

*Rename files with a sequential numeric prefix*


---

**Description**

Rename a series of files and add an incremental numeric prefix to the filenames. For example, files 'a.txt', 'b.txt', and 'c.txt' can be renamed to '1-a.txt', '2-b.txt', and '3-c.txt'.

**Usage**

```
rename_seq(
  pattern = "^[0-9]+-.[.]Rmd$",
  format = "auto",
  replace = TRUE,
  start = 1,
  dry_run = TRUE
)
```

**Arguments**

pattern	A regular expression for <code>list.files()</code> to obtain the files to be renamed. For example, to rename .jpeg files, use <code>pattern = "[.]jpeg\$"</code> .
format	The format for the numeric prefix. This is passed to <code>sprintf()</code> . The default format is <code>"%0Nd"</code> where $N = \text{floor}(\log_{10}(n)) + 1$ and $n$ is the number of files, which means the prefix may be padded with zeros. For example, if there are 150 files to be renamed, the format will be <code>"%03d"</code> and the prefixes will be 001, 002, ..., 150.
replace	Whether to remove existing numeric prefixes in filenames.
start	The starting number for the prefix (it can start from 0).
dry_run	Whether to not really rename files. To be safe, the default is TRUE. If you have looked at the new filenames and are sure the new names are what you want, you may rerun <code>rename_seq()</code> with <code>dry_run = FALSE</code> to actually rename files.

**Value**

A named character vector. The names are original filenames, and the vector itself is the new filenames.



**Examples**

```
xfun::rename_seq()
xfun::rename_seq("[.](jpeg|png)$", format = "%04d")
```

rest\_api

*Get data from a REST API***Description**

Read data from a REST API and optionally with an authorization token in the request header. The function `rest_api_raw()` returns the raw text of the response, and `rest_api()` will parse the response with `jsonlite::fromJSON()` (assuming that the response is in the JSON format).

**Usage**

```
rest_api(...)

rest_api_raw(root, endpoint, token = "", params = list(), headers = NULL)

github_api(
  endpoint,
  token = "",
  params = list(),
  headers = NULL,
  raw = !loadable("jsonlite")
)
```

**Arguments**

<code>...</code>	Arguments to be passed to <code>rest_api_raw()</code> .
<code>root</code>	The API root URL.
<code>endpoint</code>	The API endpoint.
<code>token</code>	A named character string (e.g., <code>c(token = "xxx")</code> ), which will be used to create an authorization header of the form 'Authorization: NAME TOKEN' for the API call, where 'NAME' is the name of the string and 'TOKEN' is the string. If the string does not have a name, 'Basic' will be used as the default name.
<code>params</code>	A list of query parameters to be sent with the API call.
<code>headers</code>	A named character vector of HTTP headers, e.g., <code>c(Accept = "application/vnd.github.v3+json")</code> .
<code>raw</code>	Whether to return the raw response or parse the response with <b>jsonlite</b> .

## Details

These functions are simple wrappers based on `url()` and `read_utf8()`. Specifically, the `headers` argument is passed to `url()`, and `read_utf8()` will send a ‘GET’ request to the API server. This means these functions only support the ‘GET’ method. If you need to use other HTTP methods (such as ‘POST’), you have to use other packages such as **curl** and **httr**.

`github_api()` is a wrapper function based on `rest_api_raw()` to obtain data from the GitHub API: <https://docs.github.com/en/rest>. You can provide a personal access token (PAT) via the `token` argument, or via one of the environment variables `GITHUB_PAT`, `GITHUB_TOKEN`, `GH_TOKEN`. A PAT allows for a much higher rate limit in API calls. Without a token, you can only make 60 calls in an hour.

## Value

A character vector (the raw JSON response) or an R object parsed from the JSON text.

## Examples

```
# a normal GET request
xfun::rest_api("https://httpbin.org", "/get")
xfun::rest_api_raw("https://httpbin.org", "/get")

# send the request with an auth header
xfun::rest_api("https://httpbin.org", "/headers", "OPEN SESAME!")

# with query parameters
xfun::rest_api("https://httpbin.org", "/response-headers", params = list(foo = "bar"))

# get the rate limit info from GitHub
xfun::github_api("/rate_limit")
```

---

retry

*Retry calling a function for a number of times*

---

## Description

If the function returns an error, retry it for the specified number of times, with a pause between attempts.

## Usage

```
retry(fun, ..., .times = 3, .pause = 5)
```

## Arguments

<code>fun</code>	A function.
<code>...</code>	Arguments to be passed to the function.
<code>.times</code>	The number of times.
<code>.pause</code>	The number of seconds to wait before the next attempt.

## Details

One application of this function is to download a web resource. Since the download might fail sometimes, you may want to retry it for a few more times.

## Examples

```
# read the GitHub releases info of the repo yihui/xfun
xfun::retry(xfun::github_releases, "yihui/xfun")
```

---

 rev\_check

*Run R CMD check on the reverse dependencies of a package*


---

## Description

Install the source package, figure out the reverse dependencies on CRAN, download all of their source packages, and run R CMD check on them in parallel.

## Usage

```
rev_check(
  pkg,
  which = "all",
  recheck = NULL,
  ignore = NULL,
  update = TRUE,
  timeout = getOption("xfun.rev_check.timeout", 15 * 60),
  src = file.path(src_dir, pkg),
  src_dir = getOption("xfun.rev_check.src_dir")
)

compare_Rcheck(status_only = TRUE, output = "00check_diffs.md")
```

## Arguments

pkg	The package name.
which	Which types of reverse dependencies to check. See <a href="#">tools::package_dependencies()</a> for possible values. The special value 'hard' means the hard dependencies, i.e., <code>c('Depends', 'Imports', 'LinkingTo')</code> .
recheck	A vector of package names to be (re)checked. If not provided and there are any <code>*.Rcheck</code> directories left by certain packages (this often means these packages failed the last time), recheck will be these packages; if there are no <code>*.Rcheck</code> directories but a text file <code>recheck</code> exists, recheck will be the character vector read from this file. This provides a way for you to manually specify the packages to be checked. If there are no packages to be rechecked, all reverse dependencies will be checked.

ignore	A vector of package names to be ignored in R CMD check. If this argument is missing and a file <code>'00ignore'</code> exists, the file will be read as a character vector and passed to this argument.
update	Whether to update all packages before the check.
timeout	Timeout in seconds for R CMD check to check each package. The (approximate) total time can be limited by the global option <code>xfun.rev_check.timeout_total</code> .
src	The path of the source package directory.
src_dir	The parent directory of the source package directory. This can be set in a global option if all your source packages are under a common parent directory.
status_only	If TRUE, only compare the final statuses of the checks (the last line of <code>'00check.log'</code> ), and delete <code>'*.Rcheck'</code> and <code>'*.Rcheck2'</code> if the statuses are identical, otherwise write out the full diffs of the logs. If FALSE, compare the full logs under <code>'*.Rcheck'</code> and <code>'*.Rcheck2'</code> .
output	The output Markdown file to which the diffs in check logs will be written. If the <b>markdown</b> package is available, the Markdown file will be converted to HTML, so you can see the diffs more clearly.

## Details

Everything occurs under the current working directory, and you are recommended to call this function under a designated directory, especially when the number of reverse dependencies is large, because all source packages will be downloaded to this directory, and all `'*.Rcheck'` directories will be generated under this directory, too.

If a source tarball of the expected version has been downloaded before (under the `'tarball'` directory), it will not be downloaded again (to save time and bandwidth).

After a package has been checked, the associated `'*.Rcheck'` directory will be deleted if the check was successful (no warnings or errors or notes), which means if you see a `'*.Rcheck'` directory, it means the check failed, and you need to take a look at the log files under that directory.

The time to finish the check is recorded for each package. As the check goes on, the total remaining time will be roughly estimated via  $n * \text{mean}(\text{times})$ , where  $n$  is the number of packages remaining to be checked, and `times` is a vector of elapsed time of packages that have been checked.

If a check on a reverse dependency failed, its `'*.Rcheck'` directory will be renamed to `'*.Rcheck2'`, and another check will be run against the CRAN version of the package unless `options(xfun.rev_check.compare = FALSE)` is set. If the logs of the two checks are the same, it means no new problems were introduced in the package, and you can probably ignore this particular reverse dependency. The function `compare_Rcheck()` can be used to create a summary of all the differences in the check logs under `'*.Rcheck'` and `'*.Rcheck2'`. This will be done automatically if `options(xfun.rev_check.summary = TRUE)` has been set.

A recommended workflow is to use a special directory to run `rev_check()`, set the global `options()` `xfun.rev_check.src_dir` and `repos` in the R startup (see `?Startup`) profile file `.Rprofile` under this directory, and (optionally) set `R_LIBS_USER` in `'Renviron'` to use a special library path (so that your usual library will not be cluttered). Then run `xfun::rev_check(pkg)` once, investigate and fix the problems or (if you believe it was not your fault) ignore broken packages in the file `'00ignore'`, and run `xfun::rev_check(pkg)` again to recheck the failed packages. Repeat this process until all `'*.Rcheck'` directories are gone.

As an example, I set `options(repos = c(CRAN = 'https://cran.rstudio.com'))`, `xfun.rev_check.src_dir = '~/Dropbox/repo'` in `~/.Rprofile`, and `R_LIBS_USER=~R-tmp` in `~/.Renviron`. Then I can run, for example, `xfun::rev_check('knitr')` repeatedly under a special directory `~/Downloads/revcheck`. Reverse dependencies and their dependencies will be installed to `~/R-tmp`, and **knitr** will be installed from `~/Dropbox/repo/kintr`.

### Value

A named numeric vector with the names being package names of reverse dependencies; 0 indicates check success, 1 indicates failure, and 2 indicates that a package was not checked due to global timeout.

### See Also

`devtools::revdep_check()` is more sophisticated, but currently has a few major issues that affect me: (1) It always deletes the `*.Rcheck` directories (<https://github.com/r-lib/devtools/issues/1395>), which makes it difficult to know more information about the failures; (2) It does not fully install the source package before checking its reverse dependencies (<https://github.com/r-lib/devtools/pull/1397>); (3) I feel it is fairly difficult to iterate the check (ignore the successful packages and only check the failed packages); by comparison, `xfun::rev_check()` only requires you to run a short command repeatedly (failed packages are indicated by the existing `*.Rcheck` directories, and automatically checked again the next time).

`xfun::rev_check()` borrowed a very nice feature from `devtools::revdep_check()`: estimating and displaying the remaining time. This is particularly useful for packages with huge numbers of reverse dependencies.

---

Rscript

*Run the commands Rscript and R CMD*

---

### Description

Wrapper functions to run the commands Rscript and R CMD.

### Usage

`Rscript(args, ...)`

`Rcmd(args, ...)`

### Arguments

`args` A character vector of command-line arguments.

`...` Other arguments to be passed to `system2()`.

### Value

A value returned by `system2()`.

**Examples**

```
library(xfun)
Rscript(c("-e", "1+1"))
Rcmd(c("build", "--help"))
```

---

Rscript\_call

---

*Call a function in a new R session via Rscript()*


---

**Description**

Save the argument values of a function in a temporary RDS file, open a new R session via [Rscript\(\)](#), read the argument values, call the function, and read the returned value back to the current R session.

**Usage**

```
Rscript_call(
  fun,
  args = list(),
  options = NULL,
  ...,
  wait = TRUE,
  fail = sprintf("Failed to run '%s' in a new R session", deparse(substitute(fun)))[1])
)
```

**Arguments**

fun	A function, or a character string that can be parsed and evaluated to a function.
args	A list of argument values.
options	A character vector of options to be passed to <a href="#">Rscript()</a> , e.g., "--vanilla".
..., wait	Arguments to be passed to <a href="#">system2()</a> .
fail	The desired error message when an error occurred in calling the function. If the actual error message during running the function is available, it will be appended to this message.

**Value**

If `wait = TRUE`, the returned value of the function in the new R session. If `wait = FALSE`, three file paths will be returned: the first one stores `fun` and `args` (as a list), the second one is supposed to store the returned value of the function, and the third one stores the possible error message.

**Examples**

```
factorial(10)
# should return the same value
xfun::Rscript_call("factorial", list(10))

# the first argument can be either a character string or a function
xfun::Rscript_call(factorial, list(10))

# Run Rscript starting a vanilla R session
xfun::Rscript_call(factorial, list(10), options = c("--vanilla"))
```

---

rstudio\_type

*Type a character vector into the RStudio source editor*


---

**Description**

Use the **rstudioapi** package to insert characters one by one into the RStudio source editor, as if they were typed by a human.

**Usage**

```
rstudio_type(x, pause = function() 0.1, mistake = 0, save = 0)
```

**Arguments**

x	A character vector.
pause	A function to return a number in seconds to pause after typing each character.
mistake	The probability of making random mistakes when typing the next character. A random mistake is a random string typed into the editor and deleted immediately.
save	The probability of saving the document after typing each character. Note that If a document is not opened from a file, it will never be saved.

**Examples**

```
library(xfun)
if (loadable("rstudioapi") && rstudioapi::isAvailable()) {
  rstudio_type("Hello, RStudio! xfun::rstudio_type() looks pretty cool!",
    pause = function() runif(1, 0, 0.5), mistake = 0.1)
}
```

---

same_path	<i>Test if two paths are the same after they are normalized</i>
-----------	---

---

**Description**

Compare two paths after normalizing them with the same separator (/).

**Usage**

```
same_path(p1, p2, ...)
```

**Arguments**

p1, p2	Two vectors of paths.
...	Arguments to be passed to <code>normalize_path()</code> .

**Examples**

```
library(xfun)
same_path("~/foo", file.path(Sys.getenv("HOME"), "foo"))
```

---

session_info	<i>An alternative to <code>sessionInfo()</code> to print session information</i>
--------------	--

---

**Description**

This function tweaks the output of `sessionInfo()`: (1) It adds the RStudio version information if running in the RStudio IDE; (2) It removes the information about matrix products, BLAS, and LAPACK; (3) It removes the names of base R packages; (4) It prints out package versions in a single group, and does not differentiate between loaded and attached packages.

**Usage**

```
session_info/packages = NULL, dependencies = TRUE)
```

**Arguments**

packages	A character vector of package names, of which the versions will be printed. If not specified, it means all loaded and attached packages in the current R session.
dependencies	Whether to print out the versions of the recursive dependencies of packages.



**Details**

It also allows you to only print out the versions of specified packages (via the `packages` argument) and optionally their recursive dependencies. For these specified packages (if provided), if a function `xfun_session_info()` exists in a package, it will be called and expected to return a character vector to be appended to the output of `session_info()`. This provides a mechanism for other packages to inject more information into the `session_info` output. For example, **rmarkdown** (>= 1.20.2) has a function `xfun_session_info()` that returns the version of Pandoc, which can be very useful information for diagnostics.

**Value**

A character vector of the session information marked as `raw_string()`.

**Examples**

```
xfun::session_info()
if (xfun::loadable("MASS")) xfun::session_info("MASS")
```

---

set_envvar	<i>Set environment variables</i>
------------	----------------------------------

---

**Description**

Set environment variables from a named character vector, and return the old values of the variables, so they could be restored later.

**Usage**

```
set_envvar(vars)
```

**Arguments**

`vars` A named character vector of the form `c(VARIABLE = VALUE)`. If any value is `NA`, this function will try to unset the variable.

**Details**

The motivation of this function is that `Sys.setenv()` does not return the old values of the environment variables, so it is not straightforward to restore the variables later.

**Value**

Old values of the variables (if not set, `NA`).

**Examples**

```
vars = xfun::set_envvar(c(F00 = "1234"))
Sys.getenv("F00")
xfun::set_envvar(vars)
Sys.getenv("F00")
```

---

shrink\_images

*Shrink images to a maximum width*


---

**Description**

Use `magick::image_resize()` to shrink an image if its width is larger than the value specified by the argument `width`, and optionally call `tinify()` to compress it.

**Usage**

```
shrink_images(
  width = 800,
  dir = ".",
  files = all_files("[.](png|jpe?g|webp)$", dir),
  tinify = FALSE
)
```

**Arguments**

<code>width</code>	The desired maximum width of images.
<code>dir</code>	The directory of images.
<code>files</code>	A vector of image file paths. By default, this is all <code>' .png'</code> , <code>' .jpeg'</code> , and <code>' .webp'</code> images under <code>dir</code> .
<code>tinify</code>	Whether to compress images using <code>tinify()</code> .

**Examples**

```
f = xfun::all_files("[.](png|jpe?g)$", R.home("doc"))
file.copy(f, tempdir())
f = file.path(tempdir(), basename(f))
magick::image_info(magick::image_read(f)) # some widths are larger than 300
xfun::shrink_images(300, files = f)
magick::image_info(magick::image_read(f)) # all widths <= 300 now
file.remove(f)
```

---

split_lines	<i>Split a character vector by line breaks</i>
-------------	--

---

**Description**

Call `unlist(strsplit(x, '\n'))` on the character vector `x` and make sure it works in a few edge cases: `split_lines('')` returns `''` instead of `character(0)` (which is the returned value of `strsplit('', '\n')`); `split_lines('a\n')` returns `c('a', '')` instead of `c('a')` (which is the returned value of `strsplit('a\n', '\n')`).

**Usage**

```
split_lines(x)
```

**Arguments**

`x` A character vector.

**Value**

All elements of the character vector are split by `'\n'` into lines.

**Examples**

```
xfun::split_lines(c("a", "b\nc"))
```

---

split_source	<i>Split source lines into complete expressions</i>
--------------	---

---

**Description**

Parse the lines of code one by one to find complete expressions in the code, and put them in a list.

**Usage**

```
split_source(x, merge_comments = FALSE, line_number = FALSE)
```

**Arguments**

`x` A character vector of R source code.

`merge_comments` Whether to merge consecutive lines of comments as a single expression to be combined with the next non-comment expression (if any).

`line_number` Whether to store the line numbers of each expression in the returned value.

**Value**

A list of character vectors, and each vector contains a complete R expression, with an attribute `lines` indicating the starting and ending line numbers of the expression if the argument `line_number = TRUE`.

**Examples**

```
code = c("# comment 1", "# comment 2", "if (TRUE) {", "1 + 1", "}", "print(1:5)")
xfun::split_source(code)
xfun::split_source(code, merge_comments = TRUE)
```

---

strict\_list

*Strict lists*


---

**Description**

A strict list is essentially a normal `list()` but it does not allow partial matching with `$`.

**Usage**

```
strict_list(...)

as_strict_list(x)

## S3 method for class 'xfun_strict_list'
x$name

## S3 method for class 'xfun_strict_list'
print(x, ...)
```

**Arguments**

<code>...</code>	Objects (list elements), possibly named. Ignored in the <code>print()</code> method.
<code>x</code>	For <code>as_strict_list()</code> , the object to be coerced to a strict list. For <code>print()</code> , a strict list.
<code>name</code>	The name (a character string) of the list element.

**Details**

To me, partial matching is often more annoying and surprising than convenient. It can lead to bugs that are very hard to discover, and I have been bitten by it many times. When I write `x$name`, I always mean precisely `name`. You should use a modern code editor to autocomplete the name if it is too long to type, instead of using partial names.

**Value**

Both `strict_list()` and `as_strict_list()` return a list with the class `xfun_strict_list`. Whereas `as_strict_list()` attempts to coerce its argument `x` to a list if necessary, `strict_list()` just wraps its argument `...` in a list, i.e., it will add another list level regardless if `...` already is of type list.

**Examples**

```
library(xfun)
(z = strict_list(aaa = "I am aaa", b = 1:5))
z$a # NULL!
z$aaa # I am aaa
z$b
z$c = "create a new element"

z2 = unclass(z) # a normal list
z2$a # partial matching

z3 = as_strict_list(z2) # a strict list again
z3$a # NULL again!
```

---

`strip_html`*Strip HTML tags*

---

**Description**

Remove HTML tags and comments from text.

**Usage**

```
strip_html(x)
```

**Arguments**

`x` A character vector.

**Value**

A character vector with HTML tags and comments stripped off.

**Examples**

```
xfun::strip_html("<a href=\"#\>Hello <!-- comment -->world!</a>")
```

---

str_wrap	<i>Wrap character vectors</i>
----------	-------------------------------

---

**Description**

A wrapper function to make `strwrap()` return a character vector of the same length as the input vector; each element of the output vector is a string formed by concatenating wrapped strings by `\n`.

**Usage**

```
str_wrap(...)
```

**Arguments**

... Arguments passed to `strwrap()`.

**Value**

A character vector.

**Examples**

```
x = sample(c(letters, " "), 200, TRUE, c(rep(0.5/26, 26), 0.5))
x = rep(paste(x, collapse = ""), 2)
strwrap(x, width = 30)
xfun::str_wrap(x, width = 30) # same length as x
```

---

submit_cran	<i>Submit a source package to CRAN</i>
-------------	--

---

**Description**

Build a source package and submit it to CRAN with the `curl` package.

**Usage**

```
submit_cran(file = pkg_build(), comment = "")
```

**Arguments**

file	The path to the source package tarball. By default, the current working directory is treated as the package root directory, and automatically built into a tarball, which is deleted after submission. This means you should run <code>xfun::submit_cran()</code> in the root directory of a package project, unless you want to pass a path explicitly to the file argument.
comment	Submission comments for CRAN. By default, if a file <code>'cran-comments.md'</code> exists, its content will be read and used as the comment.

**See Also**

`devtools::submit_cran()` does the same job, with a few more dependencies in addition to **curl** (such as **cli**); `xfun::submit_cran()` only depends on **curl**.

---

system3	<i>Run system2() and mark its character output as UTF-8 if appropriate</i>
---------	--

---

**Description**

This is a wrapper function based on `system2()`. If `system2()` returns character output (e.g., with the argument `stdout = TRUE`), check if the output is encoded in UTF-8. If it is, mark it with UTF-8 explicitly.

**Usage**

```
system3(...)
```

**Arguments**

...                    Passed to `system2()`.

**Value**

The value returned by `system2()`.

**Examples**

```
a = shQuote(c("-e", "print(intToUtf8(c(20320, 22909)))"))
x2 = system2("Rscript", a, stdout = TRUE)
Encoding(x2) # unknown

x3 = xfun::system3("Rscript", a, stdout = TRUE)
# encoding of x3 should be UTF-8 if the current locale is UTF-8
!l10n_info()[["UTF-8"]] || Encoding(x3) == "UTF-8" # should be TRUE
```

---

tabset	<i>Represent a (recursive) list with (nested) tabsets</i>
--------	---

---

**Description**

The tab titles are names of list members, and the tab content contains the values of list members. If a list member is also a list, it will be represented recursively with a child tabset.

**Usage**

```
tabset(x, value = str)
```

**Arguments**

x	A list.
value	A function to print the value of a list member. By default, <code>str()</code> is used to print the structure of the value. You may also use <code>dput()</code> to output the full value, but it may be slow when the size of the value is too big.

**Value**

A character vector of Markdown that can be rendered to HTML with `litedown::mark()`.

**Examples**

```
xfun::tabset(iris)
xfun::tabset(iris, dput)
xfun::tabset(iris, print)

# a deeply nested list
plot(1:10)
p = recordPlot()
xfun::tabset(p)
```

---

taml\_load

*A simple YAML reader and writer*


---

**Description**

TAML is a tiny subset of YAML. See <https://yihui.org/litedown/#sec:yaml-syntax> for its specifications.

**Usage**

```
taml_load(x, envir = parent.frame())

taml_file(path)

taml_save(x, path = NULL, indent = " ")
```

**Arguments**

x	For <code>taml_load()</code> , a character vector of the YAML content. For <code>taml_save()</code> , a list to be converted to YAML.
envir	The environment in which R expressions in YAML are evaluated. To disable the evaluation, use <code>envir = FALSE</code> .
path	A file path to read from or write to.
indent	A character string to indent sub-lists by one level.



**Value**

taml\_load() and taml\_file() return a list; if path = NULL, taml\_save() returns a character vector, otherwise the vector is written to the file specified by the path.

**Examples**

```
(res = taml_load("a: 1"))
taml_save(res)

(res = taml_load("a: 1\nb: \"foo\"\nc: null"))
taml_save(res)

(res = taml_load("a:\n b: false\n c: true\n d: 1.234\ne: bar"))
taml_save(res)
taml_save(res, indent = "\t")

taml_load("a: !expr paste(1:10, collapse = \", \")")
taml_load("a: [1, 3, 4, 2]")
taml_load("a: [1, \"abc\", 4, 2]")
taml_load("a: [\"foo\", \"bar\"]")
taml_load("a: [true, false, true]")
# the other form of array is not supported
taml_load("a:\n - b\n - c")
# and you must use the yaml package
if (loadable("yaml")) yaml_load("a:\n - b\n - c")
```

---

tinify

*Use the Tinify API to compress PNG and JPEG images*


---

**Description**

Compress PNG/JPEG images with 'api.tinify.com', and download the compressed images. These functions require R packages **curl** and **jsonlite**. tinify\_dir() is a wrapper function of tinify() to compress images under a directory.

**Usage**

```
tinify(
  input,
  output,
  quiet = FALSE,
  force = FALSE,
  key = env_option("xfun.tinify.key"),
  history = env_option("xfun.tinify.history")
)

tinify_dir(dir = ".", ...)
```

**Arguments**

input	A vector of input paths of images.
output	A vector of output paths or a function that takes input and returns a vector of output paths (e.g., <code>output = identity</code> means <code>output = input</code> ). By default, if the <code>history</code> argument is not a provided, output is input with a suffix <code>-min</code> (e.g., when <code>input = 'foo.png'</code> , <code>output = 'foo-min.png'</code> ), otherwise output is the same as input, which means the original image files will be overwritten.
quiet	Whether to suppress detailed information about the compression, which is of the form <code>'input.png (10 Kb) ==&gt; output.png (5 Kb, 50%); compression count: 42'</code> . The percentage after <code>output.png</code> stands for the compression ratio, and the compression count shows the number of compressions used for the current month.
force	Whether to compress an image again when it appears to have been compressed before. This argument only makes sense when the <code>history</code> argument is provided.
key	The Tinify API key. It can be set via either the global option <code>xfun.tinify.key</code> or the environment variable <code>R_XFUN_TINIFY_KEY</code> (see <code>env_option()</code> ).
history	Path to a history file to record the MD5 checksum of compressed images. If the checksum of an expected output image exists in this file and <code>force = FALSE</code> , the compression will be skipped. This can help you avoid unnecessary API calls.
dir	A directory under which all <code>' .png'</code> , <code>' .jpeg'</code> , and <code>' .webp'</code> files are to be compressed.
...	Arguments passed to <code>tinify()</code> .

**Details**

You are recommended to set the API key in  `.Rprofile` or  `.Renviron`. After that, the only required argument of this function is `input`. If the original images can be overwritten by the compressed images, you may either use `output = identity`, or set the value of the `history` argument in  `.Rprofile` or  `.Renviron`.

**Value**

The output file paths.

**References**

Tinify API: <https://tinypng.com/developers>.

**See Also**

The `tinieR` package (<https://github.com/jmablog/tinieR/>) is a more comprehensive implementation of the Tinify API, whereas `xfun::tinify()` has only implemented the feature of shrinking images.

**Examples**

```
f = xfun::R_logo("jpg$")
xfun::tinify(f) # remember to set the API key before trying this
```

---

tojson

*A simple JSON serializer*


---

**Description**

A JSON serializer that only works on a limited types of R data (NULL, lists, logical scalars, character/numeric vectors). A character string of the class JS\_EVAL is treated as raw JavaScript, so will not be quoted. The function `json_vector()` converts an atomic R vector to JSON.

**Usage**

```
tojson(x)

json_vector(x, to_array = FALSE, quote = TRUE)
```

**Arguments**

<code>x</code>	An R object.
<code>to_array</code>	Whether to convert a vector to a JSON array (use []).
<code>quote</code>	Whether to double quote the elements.

**Value**

A character string.

**See Also**

The `jsonlite` package provides a full JSON serializer.

**Examples**

```
library(xfun)
tojson(NULL)
tojson(1:10)
tojson(TRUE)
tojson(FALSE)
cat(tojson(list(a = 1, b = list(c = 1:3, d = "abc"))))
cat(tojson(list(c("a", "b"), 1:5, TRUE)))

# the class JS_EVAL is originally from htmlwidgets::JS()
JS = function(x) structure(x, class = "JS_EVAL")
cat(tojson(list(a = 1:5, b = JS("function() {return true;}"))))
```

---

tree	<i>Turn the output of <code>str()</code> into a tree diagram</i>
------	--

---

**Description**

The super useful function `str()` uses `..` to indicate the level of sub-elements of an object, which may be difficult to read. This function uses vertical pipes to connect all sub-elements on the same level, so it is clearer which elements belong to the same parent element in an object with a nested structure (such as a nested list).

**Usage**

```
tree(...)
```

**Arguments**

`...` Arguments to be passed to `str()` (note that the `comp.str` is hardcoded inside this function, and it is the only argument that you cannot customize).

**Value**

A character string as a `raw_string()`.

**Examples**

```
fit = lsfit(1:9, 1:9)
str(fit)
xfun::tree(fit)

fit = lm(dist ~ speed, data = cars)
str(fit)
xfun::tree(fit)

# some trivial examples
xfun::tree(1:10)
xfun::tree(iris)
```

---

try_error	<i>Try an expression and see if it throws an error</i>
-----------	--

---

**Description**

Use `tryCatch()` to check if an expression throws an error.

**Usage**

```
try_error(expr)
```

**Arguments**

expr            An R expression.

**Value**

TRUE (error) or FALSE (success).

**Examples**

```
xfun::try_error(stop("foo")) # TRUE
xfun::try_error(1:10) # FALSE
```

---

try_silent	<i>Try to evaluate an expression silently</i>
------------	---

---

**Description**

An abbreviation of `try(silent = TRUE)`.

**Usage**

```
try_silent(expr)
```

**Arguments**

expr            An R expression.

**Examples**

```
library(xfun)
z = try_silent(stop("Wrong!"))
inherits(z, "try-error")
```

---

upload_ftp	<i>Upload to an FTP server via curl</i>
------------	---

---

**Description**

The function `upload_ftp()` runs the command `curl -T file server` to upload a file to an FTP server if the system command `curl` is available, otherwise it uses the R package **curl**. The function `upload_win_builder()` uses `upload_ftp()` to upload packages to the win-builder server.

**Usage**

```
upload_ftp(file, server, dir = "")

upload_win_builder(
  file = pkg_build(),
  version = c("R-devel", "R-release", "R-oldrelease"),
  server = c("ftp", "https"),
  solaris = pkg_available("rhub")
)
```

**Arguments**

file	Path to a local file.
server	The address of the FTP server. For <code>upload_win_builder()</code> , <code>server = 'https'</code> means uploading to <code>'https://win-builder.r-project.org/upload.aspx'</code> .
dir	The remote directory to which the file should be uploaded.
version	The R version(s) on win-builder.
solaris	Whether to also upload the package to the Rhub server to check it on Solaris.

**Details**

These functions were written mainly to save package developers the trouble of going to the win-builder web page and uploading packages there manually.

**Value**

Status code returned from `system2()` or `curl::curl_fetch_memory()`.

---

upload_imgur	<i>Upload an image to imgur.com</i>
--------------	-------------------------------------

---

**Description**

This function uses the **curl** package or the system command `curl` (whichever is available) to upload a image to <https://imgur.com>.

**Usage**

```
upload_imgur(
  file,
  key = env_option("xfun.upload_imgur.key", "9f3460e67f308f6"),
  use_curl = loadable("curl"),
  include_xml = FALSE
)
```

**Arguments**

file	Path to the image file to be uploaded.
key	Client ID for Imgur. It can be set via either the global option <code>xfun.upload_imgur.key</code> or the environment variable <code>R_XFUN_UPLOAD_IMGUR_KEY</code> (see <a href="#">env_option()</a> ). If neither is set, this uses a client ID registered by Yihui Xie.
use_curl	Whether to use the R package <b>curl</b> to upload the image. If FALSE, the system command <code>curl</code> will be used.
include_xml	Whether to include the XML response in the returned value.

**Details**

One application is to upload local image files to Imgur when knitting a document with **knitr**: you can set the `knitr::opts_knit$set(upload.fun = xfun::upload_imgur)`, so the output document does not need local image files any more, and it is ready to be published online.

**Value**

A character string of the link to the image. If `include_xml = TRUE`, this string carries an attribute named XML, which is the XML response from Imgur (it will be parsed by **xml2** if available). See Imgur API in the references.

**Note**

Please register your own Imgur application to get your client ID; you can certainly use mine, but this ID is in the public domain so everyone has access to all images associated to it.

**Author(s)**

Yihui Xie, adapted from the **imguR** package by Aaron Statham

**References**

A demo: <https://yihui.org/knitr/demo/upload/>

**Examples**

```
## Not run:
f = tempfile(fileext = ".png")
png(f)
plot(rnorm(100), main = R.version.string)
dev.off()

res = imgur_upload(f, include_xml = TRUE)
res # link to original URL of the image
attr(res, "XML") # all information
if (interactive())
  browseURL(res)

# to use your own key
```

```
options(xfun.upload_imgur.key = "your imgur key")
## End(Not run)
```

---

url\_accessible      *Test if a URL is accessible*

---

### Description

Try to send a HEAD request to a URL using `curlGetHeaders()` or the **curl** package, and see if it returns a successful status code.

### Usage

```
url_accessible(x, use_curl = !capabilities("libcurl"), ...)
```

### Arguments

<code>x</code>	A URL as a character string.
<code>use_curl</code>	Whether to use the <b>curl</b> package or the <code>curlGetHeaders()</code> function in base R to send the request to the URL. By default, <b>curl</b> will be used when base R does not have the <code>libcurl</code> capability (which should be rare).
<code>...</code>	Arguments to be passed to <code>curlGetHeaders()</code> .

### Value

TRUE or FALSE.

### Examples

```
xfun::url_accessible("https://yihui.org")
```

---

url\_filename      *Extract filenames from a URLs*

---

### Description

Get the base names of URLs via `basename()`, and remove the possible query parameters or hash from the names.

### Usage

```
url_filename(x, default = "index.html")
```



**Arguments**

x	A character vector of URLs.
default	The default filename when it cannot be determined from the URL, e.g., when the URL ends with a slash.

**Value**

A character vector of filenames at the end of URLs.

**Examples**

```
xfun::url_filename("https://yihui.org/images/logo.png")
xfun::url_filename("https://yihui.org/index.html")
xfun::url_filename("https://yihui.org/index.html?foo=bar")
xfun::url_filename("https://yihui.org/index.html#about")
xfun::url_filename("https://yihui.org")
xfun::url_filename("https://yihui.org/")
```

---

valid\_syntax

*Check if the syntax of the code is valid*

---

**Description**

Try to `parse()` the code and see if an error occurs.

**Usage**

```
valid_syntax(code, silent = TRUE)
```

**Arguments**

code	A character vector of R source code.
silent	Whether to suppress the error message when the code is not valid.

**Value**

TRUE if the code could be parsed, otherwise FALSE.

**Examples**

```
xfun::valid_syntax("1+1")
xfun::valid_syntax("1+")
xfun::valid_syntax(c("if(T){1+1}", "else {2+2}"), silent = FALSE)
```

---

yaml_body	<i>Partition the YAML metadata and the body in a document</i>
-----------	---

---

**Description**

Split a document into the YAML metadata (which starts with `---` in the beginning of the document) and the body.

**Usage**

```
yaml_body(x, ..., parse = TRUE)
```

**Arguments**

x	A character vector of the document content.
...	Arguments to be passed to <code>yaml_load()</code> .
parse	Whether to parse the YAML data.

**Value**

A list of components `yaml` (the YAML data), `lines` (starting and ending line numbers of YAML), and `body` (a character vector of the body text). If YAML metadata does not exist in the document, the components `yaml` and `lines` will be missing.

**Examples**

```
xfun::yaml_body(c("---", "title: Hello", "output: litedown::html_format", "---",
  "", "Content."))
```

---

yaml_load	<i>Read YAML data</i>
-----------	-----------------------

---

**Description**

If the **yaml** package is installed, use `yaml::yaml.load()` to read the data. If not, use the simple parser `taml_load()` instead.

**Usage**

```
yaml_load(
  x,
  ...,
  handlers = NULL,
  envir = parent.frame(),
  use_yaml = loadable("yaml")
)
```

**Arguments**

x	A character vector of YAML data.
..., handlers	Arguments to be passed to <code>yml::yml.load()</code> .
envir	The environment in which R expressions in YAML are evaluated. To disable the evaluation, use <code>envir = FALSE</code> .
use_yml	Whether to use the <b>yml</b> package.

**Value**

An R object (typically a list).

**Note**

R expressions in YAML will be returned as [expressions](#) when they are not evaluated. This is different with `yml::yml.load()`, which returns character strings for expressions.

**Examples**

```
yml_load("a: 1")  
yml_load("a: 1", use_yml = FALSE)
```

# Index

- \* **datasets**
  - download\_cache, 18
  - proj\_root, 54
- .Renvirom, 22
- .Rprofile, 22
- .packages, 51
- \$.xfun\_strict\_list(strict\_list), 76
  
- alnum\_id, 4
- append\_unique(read\_utf8), 59
- append\_utf8(read\_utf8), 59
- as\_strict\_list(strict\_list), 76
- assign, 40
- attr, 5
  
- base64\_decode(base64\_encode), 5
- base64\_encode, 5
- base64\_uri, 6
- base::attr, 5
- base::attr(), 5
- base\_pkgs, 6
- basename(), 88
- bg\_process, 7
- broken\_packages, 8
- bump\_version, 8
  
- cache\_exec, 9
- cache\_exec(), 12, 40, 61
- cache\_rds, 10
- cat(), 44
- codetools::findGlobals(), 27
- codetools::findLocalsList(), 27
- compare\_Rcheck(rev\_check), 67
- crandalf\_check, 13
- crandalf\_results(crandalf\_check), 13
- csv\_options, 14
- curlGetHeaders(), 88
  
- decimal\_dot, 15
- del\_empty\_dir, 15
  
- delayedAssign(), 40
- deparse, 9
- dir.create, 16
- dir.create(), 16
- dir.exists(), 16
- dir\_create, 16
- dir\_exists, 16
- divide\_chunk, 17
- do\_once, 19
- download.file(), 19
- download\_cache, 18
- download\_file, 19
- dput(), 80
  
- embed\_dir(embed\_file), 20
- embed\_file, 20
- embed\_files(embed\_file), 20
- enc2utf8(), 59
- env\_option, 22
- env\_option(), 82, 87
- existing\_files, 23
- exit\_call, 23
- expression, 91
- expression(), 49
  
- fenced\_block, 24
- fenced\_div(fenced\_block), 24
- file.copy(), 26
- file.exists(), 16
- file.path, 29
- file.rename(), 26
- file.size, 58
- file\_exists(dir\_exists), 16
- file\_ext, 25
- file\_rename, 26
- file\_string, 26
- find\_globals, 27
- find\_globals(), 9
- find\_locals(find\_globals), 27
- find\_locals(), 9

format(), 28  
 format.xfun\_record\_results(record), 60  
 format\_bytes, 28  
 from\_root, 29  
  
 get, 40  
 github\_api(rest\_api), 65  
 github\_api(), 30  
 github\_releases, 30  
 grep(), 31  
 grep\_sub, 30  
 gsub(), 31  
 gsub\_dir(gsub\_file), 31  
 gsub\_ext(gsub\_file), 31  
 gsub\_file, 31  
 gsub\_files(gsub\_file), 31  
  
 html\_escape(html\_tag), 32  
 html\_escape(), 32  
 html\_tag, 32  
 html\_tag(), 21, 32  
 html\_value(html\_tag), 32  
 html\_value(), 32  
 html\_view(html\_tag), 32  
  
 I(), 61  
 identity, 82  
 in\_dir, 34  
 in\_dir(), 41  
 install.packages(), 50  
 install\_dir, 33  
 install\_github, 34  
 invisible(), 61  
 is\_abs\_path, 35  
 is\_arm64(is\_windows), 38  
 is\_ascii, 35  
 is\_blank, 36  
 is\_linux(is\_windows), 38  
 is\_macos(is\_windows), 38  
 is\_rel\_path(is\_abs\_path), 35  
 is\_sub\_path, 36  
 is\_unix(is\_windows), 38  
 is\_web\_path, 37  
 is\_windows, 38  
  
 join\_words, 38  
 json\_vector(tojson), 83  
  
 knitr::kable(), 43, 62  
  
 knitr::knit\_print(), 62  
  
 l10n\_info(), 45  
 lazy\_load(lazy\_save), 39  
 lazy\_load(), 39, 40  
 lazy\_save, 39  
 lazy\_save(), 39, 40  
 library(), 50  
 list(), 76  
 list.files(), 64  
 litedown::mark(), 80  
 loadable(pkg\_attach), 50  
 loadable(), 8  
  
 magic\_path, 40  
 magick::image\_resize(), 74  
 make\_fence(fenced\_block), 24  
 mark\_dirs, 41  
 md5, 42  
 md\_table, 42  
 message(), 44  
 mime::guess\_type(), 43  
 mime\_type, 43  
 msg\_cat, 44  
  
 n2w(numbers\_to\_words), 48  
 native\_encode, 45  
 new\_app, 46  
 new\_app(), 32  
 new\_record(record\_print), 62  
 new\_record(), 63  
 news(), 46  
 news2md, 46  
 normalize\_path, 47  
 normalize\_path(), 37, 72  
 normalizePath(), 47  
 numbers\_to\_words, 48  
  
 on.exit(), 23  
 options(), 19, 20, 22, 50, 68  
 optipng, 49  
  
 parse, 12  
 parse(), 89  
 parse\_only, 49  
 pkg\_attach, 50  
 pkg\_attach2(pkg\_attach), 50  
 pkg\_available(pkg\_attach), 50  
 pkg\_bib, 51

pkg\_load (pkg\_attach), 50  
 pkg\_load2 (pkg\_attach), 50  
 print(), 61, 62  
 print.xfun\_raw\_string (raw\_string), 57  
 print.xfun\_record\_results (record), 60  
 print.xfun\_strict\_list (strict\_list), 76  
 proc\_kill, 54  
 proc\_kill(), 7  
 process\_file, 53  
 proj\_root, 54  
 prose\_index, 55  
 protect\_math, 56  
  
 qs::qread(), 10  
 qs::qsave(), 10  
  
 raw\_string, 57  
 raw\_string(), 39, 73, 84  
 Rcmd (Rscript), 69  
 read\_all, 58  
 read\_bin, 58  
 read\_utf8, 59  
 read\_utf8(), 66  
 readBin(), 58  
 readRDS(), 10  
 record, 60  
 record(), 62  
 record\_print, 62  
 record\_print(), 61  
 relative\_path, 63  
 relative\_path(), 29  
 remotes::install\_github(), 34  
 rename\_seq, 64  
 requireNamespace(), 50, 51  
 rest\_api, 65  
 rest\_api\_raw (rest\_api), 65  
 retry, 66  
 rev\_check, 67  
 rev\_check(), 13  
 root\_rules (proj\_root), 54  
 round(), 43  
 Rscript, 69  
 Rscript(), 70  
 Rscript\_call, 70  
 rstudio\_type, 71  
  
 same\_path, 72  
 same\_path(), 35  
 sans\_ext (file\_ext), 25  
  
 saveRDS(), 10, 11  
 Serialize, 42  
 serialize(), 10  
 session\_info, 72  
 sessionInfo(), 72  
 set\_envvar, 73  
 show(), 61  
 shQuote(), 7  
 shrink\_images, 74  
 sort(), 53  
 sort\_file (process\_file), 53  
 split\_lines, 75  
 split\_source, 75  
 sprintf(), 64  
 Startup, 68  
 stderr(), 44  
 stdout(), 44  
 str(), 80, 84  
 str\_wrap, 78  
 strict\_list, 76  
 strip\_html, 77  
 strwrap(), 78  
 submit\_cran, 78  
 suppressMessages(), 44  
 Sys.setenv(), 73  
 system2, 7  
 system2(), 54, 69, 70, 79, 86  
 system3, 79  
  
 tabset, 79  
 taml\_file (taml\_load), 80  
 taml\_load, 80  
 taml\_load(), 90  
 taml\_save (taml\_load), 80  
 tinify, 81  
 tinify(), 74, 82  
 tinify\_dir (tinify), 81  
 tojson, 83  
 tools::file\_ext(), 25  
 tools::file\_path\_sans\_ext(), 25  
 tools::md5sum(), 42  
 tools::package\_dependencies(), 67  
 tree, 84  
 try\_error, 84  
 try\_silent, 85  
 tryCatch(), 84  
  
 unserialize(), 10  
 upload\_ftp, 85

upload\_imgur, 86  
upload\_win\_builder (upload\_ftp), 85  
url(), 66  
url\_accessible, 88  
url\_filename, 88  
url\_filename(), 19  
utils::citation(), 51, 52  
utils::toBibtex(), 51  
  
valid\_syntax, 89  
  
with\_ext (file\_ext), 25  
write\_utf8 (read\_utf8), 59  
writeLines(), 59  
  
yaml::yaml.load(), 90, 91  
yaml\_body, 90  
yaml\_load, 90