Package ‘qs’
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base85_decode

Description
Decodes a Z85 encoded string back to binary

Usage
base85_decode(encoded_string)

Arguments
encoded_string A string.

Value
The original raw vector.

base85_encode

Description
Encodes binary data (a raw vector) as ASCII text using Z85 encoding format.

Usage
base85_encode(rawdata)

Arguments
rawdata A raw vector.

Details
Z85 is a binary to ASCII encoding format created by Pieter Hintjens in 2010 and is part of the ZeroMQ RFC. The encoding has a dictionary using 85 out of 94 printable ASCII characters. There are other base 85 encoding schemes, including Ascii85, which is popularized and used by Adobe. Z85 is distinguished by its choice of dictionary, which is suitable for easier inclusion into source code for many programming languages. The dictionary excludes all quote marks and other control characters, and requires no special treatment in R and most other languages. Note: although the official specification restricts input length to multiples of four bytes, the implementation here works with any input length. The overhead (extra bytes used relative to binary) is 25%. In comparison, base 64 encoding has an overhead of 33.33%.
base91_encode

Value
A string representation of the raw vector.

References
https://rfc.zeromq.org/spec/32/

base91_decode basE91 Decoding

Description
Decodes a basE91 encoded string back to binary

Usage
base91_decode(encoded_string)

Arguments
encoded_string A string.

Value
The original raw vector.

base91_encode basE91 Encoding

Description
Encodes binary data (a raw vector) as ASCII text using basE91 encoding format.

Usage
base91_encode(rawdata, quote_character = "\\"")

Arguments
rawdata A raw vector.
quote_character The character to use in the encoding, replacing the double quote character. Must be either a single quote ('"'), a double quote ('"') or a dash ('-').
Details

basE91 (capital E for stylization) is a binary to ASCII encoding format created by Joachim Henke in 2005. The overhead (extra bytes used relative to binary) is 22.97% on average. In comparison, base 64 encoding has an overhead of 33.33%. The original encoding uses a dictionary of 91 out of 94 printable ASCII characters excluding - (dash), \ (backslash) and ' (single quote). The original encoding does include double quote characters, which are less than ideal for strings in R. Therefore, you can use the quote_character parameter to substitute dash or single quote.

Value

A string representation of the raw vector.

References

http://base91.sourceforge.net/

---

blosc_shuffle_raw

Shuffle a raw vector

Description

Shuffles a raw vector using BLOSC shuffle routines.

Usage

blosc_shuffle_raw(x, bytesofsize)

Arguments

x
  A raw vector.

bytesofsize
  Either 4 or 8.

Value

The shuffled vector

Examples

x <- serialize(1:1000L, NULL)
xshuf <- blosc_shuffle_raw(x, 4)
xunshuf <- blosc_unshuffle_raw(xshuf, 4)
blosc_unshuffle_raw  Un-shuffle a raw vector

Description

Un-shuffles a raw vector using BLOSC un-shuffle routines.

Usage

blosc_unshuffle_raw(x, bytesofsize)

Arguments

x                        A raw vector.
bytesofsize              Either 4 or 8.

Value

The unshuffled vector.

Examples

x <- serialize(1L:1000L, NULL)
xshuf <- blosc_shuffle_raw(x, 4)
xunshuf <- blosc_unshuffle_raw(xshuf, 4)

catquo

catquo

Description

Prints a string with single quotes on a new line.

Usage

catquo(...)  

Arguments

...          Arguments passed on to cat().
**decode_source**  
**Decode a compressed string**

**Description**  
A helper function for encoding and compressing a file or string to ASCII using `base91_encode()` and `qserialize()` with the highest compression level.

**Usage**  
```r  
decode_source(string)  
```

**Arguments**  
- `string` A string to decode.

**Value**  
The original (decoded) object.

**See Also**  
`encode_source()` for more details.

**encode_source**  
**Encode and compress a file or string**

**Description**  
A helper function for encoding and compressing a file or string to ASCII using `base91_encode()` and `qserialize()` with the highest compression level.

**Usage**  
```r  
encode_source(x = NULL, file = NULL, width = 120)  
```

**Arguments**  
- `x` The object to encode (if `file` is not NULL)
- `file` The file to encode (if `x` is not NULL)
- `width` The output will be broken up into individual strings, with `width` being the longest allowable string.
Details

The `encode_source()` and `decode_source()` functions are useful for storing small amounts of data or text inline to a .R or .Rmd file.

Value

A character vector in base91 representing the compressed original file or object.

Examples

```r
set.seed(1); data <- sample(500)
result <- encode_source(data)
# Note: the result string is not guaranteed to be consistent between qs or zstd versions
# but will always properly decode regardless
print(result)
result <- decode_source(result) # [1] 1 2 3 4 5 6 7 8 9 10
```

---

### is_big_endian

**System Endianness**

Description

Tests system endianness. Intel and AMD based systems are little endian, and so this function will likely return `FALSE`. The `qs` package is not capable of transferring data between systems of different endianness. This should not matter for the large majority of use cases.

Usage

```r
is_big_endian()
```

Value

`TRUE` if big endian, `FALSE` if little endian.

Examples

```r
is_big_endian() # returns FALSE on Intel/AMD systems
```
lz4_compress_bound

Description
Exports the compress bound function from the lz4 library. Returns the maximum compressed size of an object of length size.

Usage
lz4_compress_bound(size)

Arguments
size An integer size.

Value
Maximum compressed size.

Examples
lz4_compress_bound(100000)
#`lz4_compress_bound(1e9)

lz4_compress_raw

Description
Compresses to a raw vector using the lz4 algorithm. Exports the main lz4 compression function.

Usage
lz4_compress_raw(x, compress_level)

Arguments
x The object to serialize.
compress_level The compression level used. A number > 1 (higher is less compressed).

Value
The compressed data as a raw vector.
Examples

```r
x <- 1:1e6
xserialized <- serialize(x, connection=NULL)
xcompressed <- lz4_compress_raw(xserialized, compress_level = 1)
xrecovered <- unserialize(lz4_decompress_raw(xcompressed))
```

---

### Description

Decompresses an lz4 compressed raw vector.

#### Usage

```r
lz4_decompress_raw(x)
```

#### Arguments

- **x**: A raw vector.

#### Value

The de-serialized object.

Examples

```r
x <- 1:1e6
xserialized <- serialize(x, connection=NULL)
xcompressed <- lz4_compress_raw(xserialized, compress_level = 1)
xrecovered <- unserialize(lz4_decompress_raw(xcompressed))
```

---

### qcache

**Description**

Helper function for caching objects for long running tasks
Usage

qcache(
    expr,
    name,
    envir = parent.frame(),
    cache_dir = ".cache",
    clear = FALSE,
    prompt = TRUE,
    qsave_params = list(),
    qread_params = list()
)

Arguments

expr        The expression to evaluate.
name        The cached expression name (see details).
envir       The environment to evaluate expr in.
cache_dir   The directory to store cached files in.
clear       Set to TRUE to clear the cache (see details).
prompt      Whether to prompt before clearing.
qsave_params Parameters passed on to qsave.
qread_params Parameters passed on to qread.

Details

This is a (very) simple helper function to cache results of long running calculations. There are other packages specializing in caching data that are more feature complete.

The evaluated expression is saved with qsave() in <cache_dir>/<name>.qs. If the file already exists instead, the expression is not evaluated and the cached result is read using qread() and returned.

To clear a cached result, you can manually delete the associated .qs file, or you can call qcache() with clear = TRUE. If prompt is also TRUE a prompt will be given asking you to confirm deletion. If name is not specified, all cached results in cache_dir will be removed.

Examples

cache_dir <- tempdir()

a <- 1
b <- 5

# not cached
result <- qcache(a + b),
    name="aplusb",
    cache_dir = cache_dir,
    qsave_params = list(preset="fast"))

# cached
result <- qcache(a + b),
       name="aplusb",
       cache_dir = cache_dir,
       qsave_params = list(preset="fast"))

# clear cached result
qcache(name="aplusb", clear=TRUE, prompt=FALSE, cache_dir = cache_dir)

qdeserializede

Description
Reads an object from a raw vector.

Usage
qdeserializede(x, use_alt_rep=FALSE, strict=FALSE)

Arguments
x
A raw vector.
use_alt_rep
Use ALTREP when reading in string data (default FALSE). On R versions prior to 3.5.0, this parameter does nothing.
strict
Whether to throw an error or just report a warning (default: FALSE, i.e. report warning).

Details
See qserialize() for additional details and examples.

Value
The de-serialized object.

qdump

Description
Exports the uncompressed binary serialization to a list of raw vectors. For testing purposes and exploratory purposes mainly.

Usage
qdump(file)
Arguments

file A file name/path.

Value

The uncompressed serialization.

Examples

```r
x <- data.frame(int = sample(1e3, replace=TRUE),
    num = rnorm(1e3),
    char = sample(starnames$'IAU Name', 1e3, replace=TRUE),
    stringsAsFactors = FALSE)
myfile <- tempfile()
qsave(x, myfile)
x2 <- qdump(myfile)
```

Description

Reads an object in a file serialized to disk.

Usage

```r
qread(file, use_alt_rep=FALSE, strict=FALSE, nthreads=1)
```

Arguments

file The file name/path.

use_alt_rep Use ALTREP when reading in string data (default FALSE). On R versions prior to 3.5.0, this parameter does nothing.

strict Whether to throw an error or just report a warning (default: FALSE, i.e. report warning).

nthreads Number of threads to use. Default 1.

Value

The de-serialized object.
Examples

```r
x <- data.frame(int = sample(1e3, replace=TRUE),
               num = rnorm(1e3),
               char = sample(starnames$'IAU Name'`, 1e3, replace=TRUE),
               stringsAsFactors = FALSE)
myfile <- tempfile()
qsave(x, myfile)
x2 <- qread(myfile)
identical(x, x2) # returns true

# qs support multithreading
qsave(x, myfile, nthreads=2)
x2 <- qread(myfile, nthreads=2)
identical(x, x2) # returns true

# Other examples
z <- 1:1e7
myfile <- tempfile()
qsave(z, myfile)
z2 <- qread(myfile)
identical(z, z2) # returns true

w <- as.list(rnorm(1e6))
myfile <- tempfile()
qsave(w, myfile)
w2 <- qread(myfile)
identical(w, w2) # returns true
```

Description

Reads an object in a file serialized to disk using `qsavem()`.

Usage

```r
qreadm(file, env = parent.frame(), ...)
```

```r
qload(file, env = parent.frame(), ...)
```

Arguments

- **file**: The file name/path.
- **env**: The environment where the data should be loaded.
- **...**: additional arguments will be passed to qread.
Details

This function extends \texttt{qread} to replicate the functionality of \texttt{base::load()} to load multiple saved objects into your workspace. \texttt{qload} and \texttt{qreadm} are aliases of the same function.

Value

Nothing is explicitly returned, but the function will load the saved objects into the workspace.

Examples

```r
x1 <- data.frame(int = sample(1e3, replace=TRUE),
                 num = rnorm(1e3),
                 char = sample(starnames$'IAU Name', 1e3, replace=TRUE),
                 stringsAsFactors = FALSE)
x2 <- data.frame(int = sample(1e3, replace=TRUE),
                 num = rnorm(1e3),
                 char = sample(starnames$'IAU Name', 1e3, replace=TRUE),
                 stringsAsFactors = FALSE)
myfile <- tempfile()
qsavem(x1, x2, file=myfile)
rm(x1, x2)
qload(myfile)
exists('x1') && exists('x2') # returns true

# qs support multithreading
qsavem(x1, x2, file=myfile, nthreads=2)
rm(x1, x2)
qload(myfile, nthreads=2)
exists('x1') && exists('x2') # returns true
```

Description

Reads an object from a file descriptor.

Usage

```r
qread_fd(fd, use_alt_rep=FALSE, strict=FALSE)
```

Arguments

- **fd**: A file descriptor.
- **use_alt_rep**: Use ALTREP when reading in string data (default FALSE). On R versions prior to 3.5.0, this parameter does nothing.
- **strict**: Whether to throw an error or just report a warning (default: FALSE, i.e. report warning).
Details

See `qsave_fd()` for additional details and examples.

Value

The de-serialized object.

---

**qread_handle**

| qread_handle | qread_handle |

Description

Reads an object from a windows handle.

Usage

```
qread_handle(handle, use_alt_rep=FALSE, strict=FALSE)
```

Arguments

- **handle**: A windows handle external pointer.
- **use_alt_rep**: Use ALTREP when reading in string data (default FALSE). On R versions prior to 3.5.0, this parameter does nothing.
- **strict**: Whether to throw an error or just report a warning (default: FALSE, i.e. report warning).

Details

See `qsave_handle()` for additional details and examples.

Value

The de-serialized object.
**qread_ptr**

**Description**
Reads an object from an external pointer.

**Usage**
```
qread_ptr(pointer, length, use_alt_rep=FALSE, strict=FALSE)
```

**Arguments**
- `pointer`: An external pointer to memory.
- `length`: The length of the object in memory.
- `use_alt_rep`: Use ALTREP when reading in string data (default FALSE). On R versions prior to 3.5.0, this parameter does nothing.
- `strict`: Whether to throw an error or just report a warning (default: FALSE, i.e. report warning).

**Value**
The de-serialized object.

---

**qsave**

**Description**
Saves (serializes) an object to disk.

**Usage**
```
qsave(x, file, 
    preset = "high", algorithm = "zstd", compress_level = 4L, 
    shuffle_control = 15L, check_hash=TRUE, nthreads = 1)
```

**Arguments**
- `x`: The object to serialize.
- `file`: The file name/path.
- `preset`: One of "fast", "balanced", "high" (default), "archive", "uncompressed" or "custom". See section *Presets* for details.
algorithm Ignored unless preset = "custom". Compression algorithm used: "lz4", "zstd", "lz4hc", "zstd_stream" or "uncompressed".

compress_level Ignored unless preset = "custom". The compression level used.
For lz4, this number must be > 1 (higher is less compressed).
For zstd, a number between -50 to 22 (higher is more compressed). Due to the format of qs, there is very little benefit to compression levels > 5 or so.

shuffle_control Ignored unless preset = "custom". An integer setting the use of byte shuffle compression. A value between 0 and 15 (default 15). See section Byte shuffling for details.

check_hash Default TRUE, compute a hash which can be used to verify file integrity during serialization.

nthreads Number of threads to use. Default 1.

Details
This function serializes and compresses R objects using block compression with the option of byte shuffling.

Value
The total number of bytes written to the file (returned invisibly).

Presets
There are lots of possible parameters. To simplify usage, there are four main presets that are performant over a large variety of data:

- "fast" is a shortcut for algorithm = "lz4", compress_level = 100 and shuffle_control = 0.
- "balanced" is a shortcut for algorithm = "lz4", compress_level = 1 and shuffle_control = 15.
- "high" is a shortcut for algorithm = "zstd", compress_level = 4 and shuffle_control = 15.
- "archive" is a shortcut for algorithm = "zstd_stream", compress_level = 14 and shuffle_control = 15. (zstd_stream is currently single-threaded only)

To gain more control over compression level and byte shuffling, set preset = "custom", in which case the individual parameters algorithm, compress_level and shuffle_control are actually regarded.

Byte shuffling
The parameter shuffle_control defines which numerical R object types are subject to byte shuffling. Generally speaking, the more ordered/sequential an object is (e.g., 1:1e7), the larger the potential benefit of byte shuffling. It is not uncommon to improve compression ratio or compression speed by several orders of magnitude. The more random an object is (e.g., rnorm(1e7)), the less potential benefit there is, even negative benefit is possible. Integer vectors almost always benefit
from byte shuffling, whereas the results for numeric vectors are mixed. To control block shuffling, 
add +1 to the parameter for logical vectors, +2 for integer vectors, +4 for numeric vectors and/or +8 
for complex vectors.

Examples

```r
x <- data.frame(int = sample(1e3, replace=TRUE),
                num = rnorm(1e3),
                char = sample(starnames$'IAU Name', 1e3, replace=TRUE),
                stringsAsFactors = FALSE)
myfile <- tempfile()
qsave(x, myfile)
x2 <- qread(myfile)
identical(x, x2) # returns true

# qs support multithreading
qsave(x, myfile, nthreads=2)
x2 <- qread(myfile, nthreads=2)
identical(x, x2) # returns true

# Other examples
z <- 1:1e7
myfile <- tempfile()
qsave(z, myfile)
z2 <- qread(myfile)
identical(z, z2) # returns true

w <- as.list(rnorm(1e6))
myfile <- tempfile()
qsave(w, myfile)
w2 <- qread(myfile)
identical(w, w2) # returns true
```

Description

Saves (serializes) multiple objects to disk.

Usage

`qsavem(...)`

Arguments

`...` Objects to serialize. Named arguments will be passed to `qsave()` during saving. Un-named arguments will be saved. A named file argument is required.
Details

This function extends \texttt{qsave()} to replicate the functionality of \texttt{base::save()} to save multiple objects. Read them back with \texttt{qload()}.

Examples

\begin{verbatim}
x1 <- data.frame(int = sample(1e3, replace=TRUE),
    num = rnorm(1e3),
    char = sample(starnames$IAU Name, 1e3, replace=TRUE),
    stringsAsFactors = FALSE)
x2 <- data.frame(int = sample(1e3, replace=TRUE),
    num = rnorm(1e3),
    char = sample(starnames$IAU Name, 1e3, replace=TRUE),
    stringsAsFactors = FALSE)
myfile <- tempfile()
qsavem(x1, x2, file=myfile)
rm(x1, x2)
qload(myfile)
exists('x1') && exists('x2') # returns true

# qs support multithreading
qsavem(x1, x2, file=myfile, nthreads=2)
rm(x1, x2)
qload(myfile, nthreads=2)
exists('x1') && exists('x2') # returns true
\end{verbatim}

Description

Saves an object to a file descriptor.

Usage

\begin{verbatim}
qsave_fd(x, fd,
    preset = "high", algorithm = "zstd", compress_level = 4L,
    shuffle_control = 15L, check_hash=TRUE)
\end{verbatim}

Arguments

- \textbf{x} \hspace{1cm} The object to serialize.
- \textbf{fd} \hspace{1cm} A file descriptor.
- \textbf{preset} \hspace{1cm} One of "fast", "balanced", "high" (default), "archive", "uncompressed" or "custom". See section Presets for details.
- \textbf{algorithm} \hspace{1cm} \textbf{Ignored unless} preset = "custom". Compression algorithm used: "lz4", "zstd", "lz4hc", "zstd_stream" or "uncompressed".
compress_level

**Ignored unless** preset = "custom". The compression level used.

For lz4, this number must be > 1 (higher is less compressed).

For zstd, a number between -50 to 22 (higher is more compressed). Due to the format of qs, there is very little benefit to compression levels > 5 or so.

shuffle_control

**Ignored unless** preset = "custom". An integer setting the use of byte shuffle compression. A value between 0 and 15 (default 15). See section **Byte shuffling** for details.

check_hash

Default TRUE, compute a hash which can be used to verify file integrity during serialization.

**Details**

This function serializes and compresses R objects using block compression with the option of byte shuffling.

**Value**

The total number of bytes written to the file (returned invisibly).

**Presets**

There are lots of possible parameters. To simplify usage, there are four main presets that are performant over a large variety of data:

- "fast" is a shortcut for algorithm = "lz4", compress_level = 100 and shuffle_control = 0.
- "balanced" is a shortcut for algorithm = "lz4", compress_level = 1 and shuffle_control = 15.
- "high" is a shortcut for algorithm = "zstd", compress_level = 4 and shuffle_control = 15.
- "archive" is a shortcut for algorithm = "zstd_stream", compress_level = 14 and shuffle_control = 15. (zstd_stream is currently single-threaded only)

To gain more control over compression level and byte shuffling, set preset = "custom", in which case the individual parameters algorithm, compress_level and shuffle_control are actually regarded.

**Byte shuffling**

The parameter shuffle_control defines which numerical R object types are subject to **byte shuffling**. Generally speaking, the more ordered/sequential an object is (e.g., 1:1e7), the larger the potential benefit of byte shuffling. It is not uncommon to improve compression ratio or compression speed by several orders of magnitude. The more random an object is (e.g., rnorm(1e7)), the less potential benefit there is, even negative benefit is possible. Integer vectors almost always benefit from byte shuffling, whereas the results for numeric vectors are mixed. To control block shuffling, add +1 to the parameter for logical vectors, +2 for integer vectors, +4 for numeric vectors and/or +8 for complex vectors.
Description

Saves an object to a windows handle.

Usage

```r
qsave_handle(x, handle,
preset = "high", algorithm = "zstd", compress_level = 4L,
shuffle_control = 15L, check_hash=TRUE)
```

Arguments

- `x`: The object to serialize.
- `handle`: A windows handle external pointer.
- `preset`: One of "fast", "balanced", "high" (default), "archive", "uncompressed" or "custom". See section Presets for details.
- `algorithm`: Ignored unless `preset = "custom"`. Compression algorithm used: "lz4", "zstd", "lz4hc", "zstd_stream" or "uncompressed".
- `compress_level`: Ignored unless `preset = "custom"`. The compression level used.
  - For lz4, this number must be > 1 (higher is less compressed).
  - For zstd, a number between -50 to 22 (higher is more compressed). Due to the format of qs, there is very little benefit to compression levels > 5 or so.
- `check_hash`: Default TRUE, compute a hash which can be used to verify file integrity during serialization.

Details

This function serializes and compresses R objects using block compression with the option of byte shuffling.

Value

The total number of bytes written to the file (returned invisibly).
Presets

There are lots of possible parameters. To simplify usage, there are four main presets that are performant over a large variety of data:

- "fast" is a shortcut for `algorithm = "lz4", compress_level = 100 and shuffle_control = 0`.
- "balanced" is a shortcut for `algorithm = "lz4", compress_level = 1 and shuffle_control = 15`.
- "high" is a shortcut for `algorithm = "zstd", compress_level = 4 and shuffle_control = 15`.
- "archive" is a shortcut for `algorithm = "zstd_stream", compress_level = 14 and shuffle_control = 15. (zstd_stream is currently single-threaded only)

To gain more control over compression level and byte shuffling, set `preset = "custom"`, in which case the individual parameters `algorithm`, `compress_level` and `shuffle_control` are actually regarded.

Byte shuffling

The parameter `shuffle_control` defines which numerical R object types are subject to byte shuffling. Generally speaking, the more ordered/sequential an object is (e.g., `1:1e7`), the larger the potential benefit of byte shuffling. It is not uncommon to improve compression ratio or compression speed by several orders of magnitude. The more random an object is (e.g., `rnorm(1e7)`), the less potential benefit there is, even negative benefit is possible. Integer vectors almost always benefit from byte shuffling, whereas the results for numeric vectors are mixed. To control block shuffling, add +1 to the parameter for logical vectors, +2 for integer vectors, +4 for numeric vectors and/or +8 for complex vectors.

---

**Description**

Saves an object to a raw vector.

**Usage**

```r
qserialize(x, preset = "high",
algorithm = "zstd", compress_level = 4L,
shuffle_control = 15L, check_hash=TRUE)
```
Arguments

x
The object to serialize.

preset
One of "fast", "balanced", "high" (default), "archive", "uncompressed" or "custom". See section Presets for details.

algorithm
Ignored unless preset = "custom". Compression algorithm used: "lz4", "zstd", "lz4hc", "zstd_stream" or "uncompressed".

compress_level
Ignored unless preset = "custom". The compression level used.
For lz4, this number must be > 1 (higher is less compressed).
For zstd, a number between -50 to 22 (higher is more compressed). Due to the format of qs, there is very little benefit to compression levels > 5 or so.

shuffle_control
Ignored unless preset = "custom". An integer setting the use of byte shuffle compression. A value between 0 and 15 (default 15). See section Byte shuffling for details.

check_hash
Default TRUE, compute a hash which can be used to verify file integrity during serialization.

Details

This function serializes and compresses R objects using block compression with the option of byte shuffling.

Value

A raw vector.

Presets

There are lots of possible parameters. To simplify usage, there are four main presets that are performant over a large variety of data:

• "fast" is a shortcut for algorithm = "lz4", compress_level = 100 and shuffle_control = 0.

• "balanced" is a shortcut for algorithm = "lz4", compress_level = 1 and shuffle_control = 15.

• "high" is a shortcut for algorithm = "zstd", compress_level = 4 and shuffle_control = 15.

• "archive" is a shortcut for algorithm = "zstd_stream", compress_level = 14 and shuffle_control = 15. (zstd_stream is currently single-threaded only)

To gain more control over compression level and byte shuffling, set preset = "custom", in which case the individual parameters algorithm, compress_level and shuffle_control are actually regarded.
Byte shuffling

The parameter shuffle_control defines which numerical R object types are subject to byte shuffling. Generally speaking, the more ordered/sequential an object is (e.g., `1:1e7`), the larger the potential benefit of byte shuffling. It is not uncommon to improve compression ratio or compression speed by several orders of magnitude. The more random an object is (e.g., `rnorm(1e7)`), the less potential benefit there is, even negative benefit is possible. Integer vectors almost always benefit from byte shuffling, whereas the results for numeric vectors are mixed. To control block shuffling, add +1 to the parameter for logical vectors, +2 for integer vectors, +4 for numeric vectors and/or +8 for complex vectors.

---

### starnames

**Official list of IAU Star Names**

---

**Description**

Data from the International Astronomical Union. An official list of the 336 internationally recognized named stars, updated as of June 1, 2018.

**Usage**

data(starnames)

**Format**

A data.frame with official IAU star names and several properties, such as coordinates.

**Source**

Naming Stars | International Astronomical Union.

**References**


**Examples**

data(starnames)
zstd_compress_bound  Zstd compress bound

Description
Exports the compress bound function from the zstd library. Returns the maximum compressed size of an object of length size.

Usage
zstd_compress_bound(size)

Arguments
size  An integer size

Value
maximum compressed size

Examples
zstd_compress_bound(100000)
zstd_compress_bound(1e9)

zstd_compress_raw  Zstd compression

Description
Compresses to a raw vector using the zstd algorithm. Exports the main zstd compression function.

Usage
zstd_compress_raw(x, compress_level)

Arguments
x  The object to serialize.
compress_level  The compression level used (default 4). A number between -50 to 22 (higher is more compressed). Due to the format of qs, there is very little benefit to compression levels > 5 or so.

Value
The compressed data as a raw vector.
**Examples**

```r
x <- 1:1e6
xserialized <- serialize(x, connection=NULL)
xcompressed <- zstd_compress_raw(xserialized, compress_level = 1)
xrecovered <- unserialize(zstd_decompress_raw(xcompressed))
```

---

**Description**

Decompresses a zstd compressed raw vector.

**Usage**

```r
zstd_decompress_raw(x)
```

**Arguments**

- `x` A raw vector.

**Value**

The de-serialized object.

**Examples**

```r
x <- 1:1e6
xserialized <- serialize(x, connection=NULL)
xcompressed <- zstd_compress_raw(xserialized, compress_level = 1)
xrecovered <- unserialize(zstd_decompress_raw(xcompressed))
```
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