Package 'container'

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Type Package

Title Extending Base 'R' Lists

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Description Extends the functionality of base 'R' lists and provides specialized data structures 'deque', 'set', 'dict', and 'dict.table', the latter to extend the 'data.table' package.

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---

add *Add Elements to Containers*

Description

Add elements to container-like objects.

Usage

```
add(.x, ...)

ref_add(.x, ...)

## S3 method for class 'Container'
add(.x, ...)

## S3 method for class 'Container'
ref_add(.x, ...)

## S3 method for class 'Dict'
add(.x, ...)

## S3 method for class 'Dict'
ref_add(.x, ...)

## S3 method for class 'dict.table'
add(.x, ...)

## S3 method for class 'dict.table'
ref_add(.x, ...)
```

Arguments

`.x`	an R object of the respective class.
`...`	elements to be added.

Value

For Container, an object of class Container (or one of the respective derived classes).

For dict.table an object of class dict.table.

Note

While add uses copy semantics ref_add works by reference.

If `.x` is a Container, Set or Deque object, the elements being added can (but must not) be named.

If `.x` is a Dict or dict.table object, all elements *must* be of the form `key = value`. If one of the keys already exists, an error is given.

Examples

```
co = container(1)
add(co, 1, b = 2, c = container(1:3))

s = setnew(1)
add(s, 1, 1, b = 2, "1", co = container(1, 1))

d = dict(a = 1)
add(d, b = 2, co = container(1:3))

try(add(d, a = 7:9))  # key 'a' already in Dict

dit = dict.table(a = 1:3)
add(dit, b = 3:1, d = 4:6)

try(add(dit, a = 7:9))  # column 'a' already exists

dit = dict.table(a = 1:3)
add(dit, b = 3:1, d = 4:6)

try(add(dit, a = 7:9))  # column 'a' already exists
```

---

addleft *Add Elements to the Left of Deques*

Description

Add elements to left side of Deque objects.

Usage

```
addleft(.x, ...)

ref_addleft(.x, ...)

## S3 method for class 'Deque'
addleft(.x, ...)

## S3 method for class 'Deque'
ref_addleft(.x, ...)
```

Arguments

`.x`	a `[Deque]` object
`...`	elements to be added.

Value

For Deque, an object of class Deque with the elements being added to the left of `.x`.

Note

While addleft uses copy semantics ref_addleft work by reference.

Examples

```
d = deque(0)
add(d, a = 1, b = 2)         # |0, a = 1, b = 2|
addleft(d, a = 1, b = 2)     # |b = 2, a = 1, 0|
```

---

at *Extract Elements Safely*

Description

Extract parts of a Container at given indices. If an index is invalid, an error is signaled. If given as a string, the element matching the name is returned. If there are two or more identical names, the value of the first match (i.e. *leftmost* element) is returned. Indices can be letters or numbers, or both at the same time.

Usage

```
at(.x, ...)

## S3 method for class 'Container'
at(.x, ...)

## S3 method for class 'dict.table'
at(.x, ...)
```

Arguments

`.x`	an R object of the respective class.
`...`	indices of elements to be extracted

Value

For `Container`, returns the values at the given indidces.

For `dict.table`, returns the columns at the given indices.

See Also

`peek_at()` for less strict extraction

Examples

```
# Container
co = container(a = 1, 2, b = 3, 4)
at(co, 1:3)
at(co, "a", "b", 2)
try(at(co, "x"))     # index 'x' not found
try(at(co, 1:10))    # index 5 exceeds length of Container
# Dict
d = dict(a = 1, b = 3)
at(d, 1:2)
at(d, "a", 2)
try(at(d, "x"))      # index 'x' not found
try(at(d, 1:3))      # index 5 exceeds length of Dict

# dict.table
dit = dict.table(a = 1:3, b = 4:6)
at(dit, "a")
at(dit, 2)
at(dit, "a", 2)
try(at(dit, "x"))     # index 'x' not found
try(at(dit, 1:3))     # index 3 exceeds length of dict.table
```

---

at2 *Extract Single Elements Safely*

Description

Extracts the value of a Container at the given index. If the index is invalid, an error is signaled. If given as a string, the element matching the name is returned. If there are two or more identical names, the value of the first match (i.e. *leftmost* element) is returned. Extract value at index. If index is invalid or not found, an error is signaled. If given as a string, the element matching the name is returned. If there are two or more identical names, the value of the first match (i.e. *leftmost* element) is returned.

Usage

```
at2(x, ...)

## S3 method for class 'Container'
at2(x, index, ...)

## S3 method for class 'dict.table'
at2(x, index, ...)
```

Arguments

x	an R object of the respective class.
...	other arguments passed to or from methods.
index	character name or numeric position of the sought value.

Value

For `Container`, returns the value at the given index.

For `dict.table`, returns the column at the given `index` or signals an error if not found.

See Also

`peek_at2()` for less strict extraction

Examples

```
# Container
co = container(a = 1, 2, b = 3, 4)
at2(co, 1)
at2(co, "a")
at2(co, 2)
try(at2(co, "x"))     # index 'x' not found
try(at2(co, 5))       # index 5 exceeds length of Container

# Dict
d = dict(a = 1, b = 3)
at2(d, 1)
at2(d, "a")
at2(d, 2)
try(at2(d, "x"))     # index 'x' not found
try(at2(d, 5))       # index 5 exceeds length of Dict

# dict.table
dit = dict.table(a = 1:3, b = 4:6)
at2(dit, 1)
at2(dit, "a")
at2(dit, 2)
try(at2(dit, "x"))     # index 'x' not found
try(at2(dit, 5))       # index 5 exceeds length of dict.table
```

---

clear *Clear a Container*

Description

Removes all elements from the container object.

Usage

```
clear(x)

ref_clear(x)

## S3 method for class 'Container'
clear(x)
```

```
## S3 method for class 'Container'
ref_clear(x)

## S3 method for class 'dict.table'
clear(x)

## S3 method for class 'dict.table'
ref_clear(x)
```

Arguments

x	any R object.

Value

For Container, an object of class Container (or one of the respective derived classes).

For dict.table an object of class dict.table.

Examples

```
co = container(1, 2, mean)
clear(co)
co
ref_clear(co)
co

dit = dict.table(a = 1, b = 2)
clear(dit)
dit              # original was not touched
ref_clear(dit)
dit              # original was cleared
```

---

clone *Clone an Object*

Description

Creates a copy of the object.

Usage

```
clone(x)

## S3 method for class 'Container'
clone(x)

## S3 method for class 'dict.table'
clone(x)
```

Arguments

x	any R object.

Value

A copy of the object.

Examples

```
co = container(1, 2, 3)
co2 = clone(co)
co == co2

d = dict.table(a = 1:2, b = 3:4)
d2 = clone(d)
ref_clear(d)
print(d2)
```

Container *Container Class*

Description

This class implements a container data structure with typical member functions to insert, delete and access elements from the container. For the standard S3 interface, see `container()`.

Details

This class inherits from class Iterable and serves as the base class for Deque, Set, and Dict.

Super class

`container::Iterable` -> `Container`

Methods

Public methods:

- `Container$new()`
- `Container$add()`
- `Container$at()`
- `Container$at2()`
- `Container$clear()`
- `Container$count()`
- `Container$delete()`
- `Container$delete_at()`
- `Container$discard()`

- Container$discard_at()
- Container$empty()
- Container$get_compare_fun()
- Container$has()
- Container$has_name()
- Container$is_empty()
- Container$length()
- Container$names()
- Container$peek_at()
- Container$peek_at2()
- Container$pop()
- Container$print()
- Container$rename()
- Container$replace()
- Container$replace_at()
- Container$remove()
- Container$size()
- Container$type()
- Container$update()
- Container$values()
- Container$clone()

Method `new()`**:** constructor

Usage:

```
Container$new(...)
```

Arguments:

`...` initial elements put into the `Container`

Returns: the `Container` object

Method `add()`**:** add element

Usage:

```
Container$add(value, name = NULL)
```

Arguments:

`value` value of `ANY` type to be added to the `Container`.

`name` `character` optional name attribute of the value.

Returns: the `Container` object

Method `at()`**:** Same as `at2` (see below) but accepts a vector of indices and always returns a `Container` object.

Usage:

```
Container$at(index)
```

Arguments:

`index` vector of indices.

Returns: `Container` object with the extracted elements.

Method `at2()`**:** Extract value at index. If index is invalid or not found, an error is signaled. If given as a string, the element matching the name is returned. If there are two or more identical names, the value of the first match (i.e. *leftmost* element) is returned.

Usage:

```
Container$at2(index)
```

Arguments:

`index` Must be a single number > 0 or a string.

Returns: If given as a number, the element at the corresponding position, and if given as a string, the element at the corresponding name matching the given string is returned.

Method `clear()`**:** delete all elements from the `Container`

Usage:

```
Container$clear()
```

Returns: the cleared `Container` object

Method `count()`**:** Count number of element occurences.

Usage:

```
Container$count(elem)
```

Arguments:

`elem` element to be counted.

Returns: `integer` number of `elem` occurences in the `Container()`

Method `delete()`**:** Search for occurence(s) of `elem` in `Container` and remove first one that is found. If `elem` does not exist, an error is signaled.

Usage:

```
Container$delete(elem)
```

Arguments:

`elem` element to be removed from the `Container`.

Returns: the `Container` object

Method `delete_at()`**:** Delete value at given index. If index is not found, an error is signaled.

Usage:

```
Container$delete_at(index)
```

Arguments:

`index` `character` or `numeric` index

Returns: the `Container` object

Method `discard()`**:** Search for occurence(s) of `elem` in `Container` and remove first one that is found.

Usage:

```
Container$discard(elem)
```

Arguments:

`elem` element to be discarded from the `Container`. If not found, the operation is ignored and the object is *not* altered.

Returns: the `Container` object

Method `discard_at()`**:** Discard value at given index. If index is not found, the operation is ignored.

Usage:

```
Container$discard_at(index)
```

Arguments:

`index` `character` or `numeric` index

Returns: the `Container` object

Method `empty()`**:** This function is deprecated. Use `is_empty()` instead.

Usage:

```
Container$empty()
```

Method `get_compare_fun()`**:** Get comparison function used internally by the `Container` object to compare elements.

Usage:

```
Container$get_compare_fun()
```

Method `has()`**:** Determine if `Container` has some element.

Usage:

```
Container$has(elem)
```

Arguments:

`elem` element to search for

Returns: `TRUE` if `Container` contains `elem` else `FALSE`

Method `has_name()`**:** Determine if `Container` object contains an element with the given name. If called with no argument, the function determines whether *any* element is named.

Usage:

```
Container$has_name(name)
```

Arguments:

`name` `character` the name

Returns: `TRUE` if `Container` has the `name` otherwise `FALSE`

Method `is_empty()`**:** Check if `Container` is empty

Usage:

```
Container$is_empty()
```

Returns: TRUE if the Container is empty else FALSE.

Method length(): Number of elements of the Container.

Usage:

```
Container$length()
```

Returns: integer length of the Container, that is, the number of elements it contains.

Method names(): Names of the elements.

Usage:

```
Container$names()
```

Returns: character the names of the elements contained in x

Method peek_at(): Same as peek_at2 (see below) but accepts a vector of indices and always returns a Container object.

Usage:

```
Container$peek_at(index, default = NULL)
```

Arguments:

index vector of indices.

default the default value to return in case the value at index is not found.

Returns: Container object with the extracted elements.

Method peek_at2(): Peek at index and extract value. If index is invalid, missing, or not not found, return default value.

Usage:

```
Container$peek_at2(index, default = NULL)
```

Arguments:

index numeric or character index to be accessed.

default the default value to return in case the value at index is not found.

Returns: the value at the given index or (if not found) the given default value.

Method pop(): Get value at index and remove it from Container. If index is not found, raise an error.

Usage:

```
Container$pop(index)
```

Arguments:

index Must be a single number > 0 or a string.

Returns: If given as a number, the element at the corresponding position, and if given as a string, the element at the corresponding name matching the given string is returned.

Method print(): Print object representation

Usage:

```
Container$print(...)
```

Arguments:

... further arguments passed to format()

Returns: invisibly returns the Container object

Method rename(): Rename a key in the Container. An error is signaled, if either the old key is not in the Container or the new key results in a name-clash with an existing key.

Usage:

```
Container$rename(old, new)
```

Arguments:

old character name of key to be renamed.

new character new key name.

Returns: the Container object

Method replace(): Replace one element by another element. Search for occurence of old and, if found, replace it by new. If old does not exist, an error is signaled, unless add was set to TRUE, in which case new is added.

Usage:

```
Container$replace(old, new, add = FALSE)
```

Arguments:

old element to be replaced

new element to be put instead of old

add logical if TRUE the new element is added in case old does not exists.

Returns: the Container object

Method replace_at(): Replace value at given index. Replace value at index by given value. If index is not found, an error is signalled, unless add was set to TRUE, in which case new is added.

Usage:

```
Container$replace_at(index, value, add = FALSE)
```

Arguments:

index character or numeric index

value ANY new value to replace the old one.

add logical if TRUE the new value element would be added in case index did not exists.

Returns: the Container object

Method remove(): This function is deprecated. Use delete() instead.

Usage:

```
Container$remove(elem)
```

Arguments:

elem element to be deleted from the Container. If element is not found in the Container, an error is signaled.

Returns: the Container object

Method size(): This function is deprecated. Use length() instead.

Usage:

```
Container$size()
```

Returns: the `Container` length

Method `type()`**:** This function is deprecated and of no real use anymore.

Usage:

```
Container$type()
```

Returns: type (or mode) of internal vector containing the elements

Method `update()`**:** Add elements of `other` to this if the name is not in the `Container` and update elements with existing names.

Usage:

```
Container$update(other)
```

Arguments:

`other` `Iterable` object used to update this.

Returns: returns the `Container`

Method `values()`**:** Get `Container` values

Usage:

```
Container$values()
```

Returns: elements of the container as a base list

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
Container$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Author(s)

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See Also

`container()`, Iterable, Deque, Set, and Dict

Examples

```
co = Container$new(1:5, c = Container$new("a", 1), l = list())
co$print()
co$length()
co$names()
co$clear()

# Extract
co = Container$new(a = 1, b = 2, c = 3, d = 4)
```

```
co$at(1:2)
co$at(c(1, 4))
co$at(list("d", 2))
co$at2(1)

try(co$at(0:2))  # index must be > 0

co$peek_at(0:2)
co$peek_at(0:2, default = 1)

# Replace
co$replace(4, 9)
co$replace(9, 11)
co$replace_at(1, -1)

try(co$replace_at(11, 1)) # index 11 exceeds length of Container

# Delete
co$delete(-1)
co$delete_at(3)

try(co$delete_at(3))     # index 3 exceeds length of Container

co$discard(3)

co2 = Container$new(b = 0)
co2$add(0, name = "a")
co$update(co2)
co$pop(1)
co
```

`ContainerS3` *Container - Enhancing R's list*

Description

A container is a data structure with typical member functions to insert, delete and access elements from the container object. It can be considered as a base R list with extended functionality. The Container class also serves as the base class for Deque, Set, and Dict objects.

Usage

```
container(...)

cont(...)

as.container(x)

as.cont(x)
```

```
is.container(x)

## S3 method for class 'Container'
as.list(x, deep = TRUE, ...)

## S3 method for class 'Container'
length(x)

## S3 method for class 'Container'
names(x)

## S3 replacement method for class 'Container'
names(x) <- value
```

Arguments

...	(possibly named) elements to be put into or removed from the Container, or additional arguments passed from and to methods.
x	R object of ANY type for as.container and is.container or of class Container for the S3 methods.
deep	logical(1) indicating whether a deep copy of the elements should be made when converting to a list.
value	character vector of names.

Details

Methods that alter Container objects usually come in two versions providing either copy or reference semantics where the latter start with 'ref_' to note the reference semantic, for example, add() and ref_add().

- container(...) initializes and returns a Container object.
- cont(...) is a short cut for container(...).
- as.container(x) or as.cont(x) coerce x to a Container
- is.container(x) check if x is a Container
- as.list(x) converts container x to a base R list. If deep is TRUE, all of the container's elements are copied (deeply) during the conversion.
- length(x) return the number of elements contained in x.
- names(x) return the names of the elements contained in x.
- names(x) <- value sets the names of x.
- x + y combines x and y into a new container by appending y to x.

- `x - y` element-wise discards all items of `y` from `x`, given the element was contained in `x`. The result is always a container.
- `x == y` is `TRUE` if the contents of `x` and `y` are lexicographically *equal*.
- `x != y` is `TRUE` if the contents of `x` and `y` are not equal.
- `x < y` is `TRUE` if the contents of x are lexicographically *less* than the contents of y.
- `x <= y` is `TRUE` if the contents of x are lexicographically *less* than or *equal* to the contents of y.
- `add(.x, ...)` and `ref_add(.x, ...)` add elements to `.x`.
- `at(.x, ...,)` returns the value at the given indices. Indices can be letters or numbers or both. All indices must exist.
- `at2(x, index)` returns the value at the given index or signals an error if not found.
- `clear(x)` and `ref_clear(x)` remove all elements from `x`.
- `clone(x)` create a copy of `x`.
- `count(x, elem)` count how often `elem` occurs in `x`.
- `delete(.x, ...)` and `ref_delete(.x, ...)` find and remove elements. If one or more elements don't exist, an error is signaled.
- `delete_at(.x, ...)` and `ref_delete_at(.x, ...)` find and remove values at given indices. If any given index is invalid, an error is signaled.
- `discard(.x, ...)` and `ref_discard(.x, ...)` find and discard elements. Elements that don't exist, are ignored.
- `discard_at(.x, ...)` and `ref_discard_at(.x, ...)` find and discard values at given indices. Invalid indices are ignored.
- `has(x, elem)` `TRUE` if element is in `x` and otherwise `FALSE`.
- `has_name(x, name)` check if `name` is in `x`
- `is_empty(x)` `TRUE` if object is empty otherwise `FALSE`
- `peek_at(x, ..., .default = NULL)` returns the value at the given indices or (if not found) the given default value.
- `peek_at2(x, index, default)` returns the value at the given index or (if not found) the given default value.
- `ref_pop(.x, index)` return element at given index and remove it from the `container` object.
- `rename(.x, old, new)` and `ref_rename(.x, old, new)` rename one or more keys from `old` to `new`, respectively, by copy and in place (i.e. by reference).

- `replace(.x, old, new, add = FALSE)` and `ref_replace(.x, old, new, add = FALSE)` try to find element `old` and replace it with element `new`. If `old` does not exist, an error is raised, unless `add` was set to `TRUE`.

- `replace_at(.x, .., .add = FALSE)` and `ref_replace_at(.x, ..., .add = FALSE)` replace values at given indices. If a given index is invalid, an error is signaled unless `.add` was set to `TRUE`.

See Also

For the class documentation see Container. Objects of the derived classes can be created by deque, setnew, and dict.

Examples

```
co = container(1:5, c = container("a", 1), l = list())
is.container(co)
print(co)
length(co)
names(co)

unpack(co)   # flatten recursively similar to unlist

# Math
co = container(1, 2, -(3:5))
co
abs(co)
cumsum(co)
round(co)
exp(co)

# Summary
range(co)
min(co)
max(co)

# Arithmetic
c1 = container(1, 1:2)
c2 = container(2, 1:2)
c1 + c2     # same as c(c1, c2)
c2 + c1     # same as c(c2, c1)

c1 - c2
c2 - c1
c1 - c1

# Comparison
c1 = container(1, 2, 3)
c2 = container(1, 3, 2)
c1 == c1            # TRUE
c1 != c2            # TRUE
c1 <= c1            # TRUE
```

```
c1 == c2            # FALSE
c1 < c2             # TRUE
c1 < container(2)   # TRUE
c1 < container()    # FALSE

# Extract or replace
co <- container(a = 1, b = 2, c = 3, d = 4)
co[1:2]              # [a = 1, b = 2]
co[1, 4]             # [a = 1, d = 4]
co[0:10]             # [a = 1, b = 2, c = 3, d = 4]
co[list(1, "d")]     # [a = 1, d = 4]
co["d", 2]           # same
co[-c(1:2)]          # [c = 3, d = 4]
co[-1, -4]           # [b = 2, c = 3]
co[-"a", -"d"]       # [b = 2, c = 3]
co[a:b]              # [a = 1, b = 2]

co = container(a = 1, b = 2)
co[[1]]
co[["a"]]
co[["x"]]
co = container(a = 1, b = "bar")
(co[1:2] <- 1:2)

try({
co[3] <- 3 # index out of range
})
(co[list(1, "b")] <- 3:4)   # mixed numeric/character index

co = container(a = 1, b = 2)
co[[1]] <- 9
co[["b"]] <- 8
co[["x"]] <- 7
co$z <- 99
print(co)

# Replace 8 by 0
co[[{8}]] <- 0
print(co)


co = container(a = 1, b = "bar")
co$f <- 3
co$b <- 2
co


co = container(1)
add(co, 1, b = 2, c = container(1:3))


co = container(a = 1, 2, b = 3, 4)
at(co, 1:3)
```

```
at(co, "a", "b", 2)
try(at(co, "x"))     # index 'x' not found
try(at(co, 1:10))    # index 5 exceeds length of Container

co = container(a = 1, 2, b = 3, 4)
at2(co, 1)
at2(co, "a")
at2(co, 2)
try(at2(co, "x"))     # index 'x' not found
try(at2(co, 5))       # index 5 exceeds length of Container

co = container(1, 2, mean)
clear(co)
print(co)    # Original was not touched
ref_clear(co)   # Clears original
print(co)

co = container(1, 2, 3)
co2 = clone(co)
co == co2

co = container("a", "b", "a", mean, mean)
count(co, "a")
count(co, mean)
count(co, "c")

co = container("a", 1:3, iris)
print(co)
delete(co, 1:3, "a")
delete(co, iris)
try({
delete(co, "b")   # "b" is not in Container
})

co = container(a = 1, b = 2, 3)
delete_at(co, "a", "b")          # [3]
delete_at(co, 1:2)               # [3]
delete_at(co, "a", 3)            # [b = 2]
try({
 delete_at(co, 4)                 # index out of range
 delete_at(co, "x")               # names(s) not found: 'x'
})

co = container("a", num = 1:3, data = iris)
print(co)
discard(co, 1:3, "a")
discard(co, iris)
discard(co, "b")  # ignored

co = container(a = 1, b = 2, 3)
discard_at(co, "a", "b")         # [3]
discard_at(co, 1:2)              # [3]
discard_at(co, "a", 3)           # [b = 2]
```

```
discard_at(co, "x")              # ignored

co = container(1, 2, mean)
has(co, 1)                    # TRUE
has(co, mean)                 # TRUE
has(co, 1:2)                  # FALSE

co = container(a = 1, 2, f = mean)
has_name(co, "a")    # TRUE
has_name(co, "f")    # TRUE
has_name(co, "2")    # FALSE

co = container(1, 2)
is_empty(co)
is_empty(clear(co))

co = container(a = 1, 2, b = 3, 4)
peek_at(co, 1)
peek_at(co, "a")
peek_at(co, "x")
peek_at(co, "x", .default = 0)
peek_at(co, "a", "x", 2, 9, .default = -1)

co = container(a = 1, 2, b = 3, 4)
peek_at2(co, 1)
peek_at2(co, "a")
peek_at2(co, "x")
peek_at2(co, "x", default = 0)

co = container(a = 1, b = 1:3, d = "foo")
ref_pop(co, "b")
ref_pop(co, 1)

try({
ref_pop(co, "x")  # index 'x' not found
})
co = container(a = 1, b = 2, 3)
rename(co, c("a", "b"), c("a1", "y"))
print(co)
ref_rename(co, c("a", "b"), c("a1", "y"))
print(co)

co = container("x", 9)
replace(co, 9, 0)
replace(co, "x", 0)
try({
replace(co, "z", 0)              # old element ("z") is not in Container
})
replace(co, "z", 0, add = TRUE)  # ok, adds the element

co = container(a = 0, b = "z")
replace_at(co, a = 1, b = 2)
replace_at(co, 1:2, 1:2)                # same
```

```
replace_at(co, c("a", "b"), list(1, 2))  # same

try({
replace_at(co, x = 1)                    # names(s) not found: 'x'
})
replace_at(co, x = 1, .add = TRUE)       # ok (adds x = 1)
```

ContainerS4 *S4 methods for Container*

Description

Membership operator for Container

Usage

```
x %in% table

## S4 method for signature 'ANY,Container'
x %in% table

## S4 method for signature 'Container,ANY'
x %in% table

## S4 method for signature 'Container,Container'
x %in% table
```

Arguments

x	Container objects
table	Container objects

Value

A logical vector indicating if each element of x is found

Examples

```
co <- container(a = 1, 2, b = 3)
c(1, 3, 5) %in% co                       # TRUE TRUE FALSE
c(x = 1, y = 2, z = 9) %in% co           # c(x = TRUE, y = TRUE, z = FALSE)
list(x = 1, y = 2, z = 9) %in% co        # c(x = TRUE, y = TRUE, z = FALSE)

co2 <- container(a = NA, b = 2)
v <- c(x = 1, y = NA_real_, z = 2)
v %in% co2                               # c(x = FALSE, y = FALSE, z = TRUE)
co2 %in% v                               # c(a = FALSE, b = TRUE)
```

`container_options` *Set Container Package Options*

Description

Set Container Package Options

Usage

```
container_options(..., .reset = FALSE)

getContainerOption(x, default = NULL)
```

Arguments

`...`	any options can be defined, using name = value.
`.reset`	`logical` if `TRUE`, the options are reset to their default and returned.
`x`	a character string holding an option name.
`default`	if the specified option is not set in the options list, this value is returned.

Value

- `container_options()` returns a list of all set options sorted by name.
- `container_options(name)`, a list of length one containing the set value, or `NULL` if it is unset. Can also be multiple names (see Examples).
- `container_options(key = value)` sets the option with name `key` to `value` and returns the previous options invisibly.

Container Options

- `compare` (default = `all.equal`)
- `useDots` (default = `TRUE`) whether to abbreviate long container elements with `...` when exceeding `vec.len` (see below). If `FALSE`, they are abbreviated as `<<type(length)>>`.
- `vec.len` (default = 4) the length limit at which container vectors are abbreviated.

Examples

```
co = container(1L, 1:10, as.list(1:5))
co

container_options(useDots = FALSE)
co

container_options(useDots = TRUE, vec.len = 6)
co
```

```
has(co, 1.0)

container_options(compare = "identical")

has(co, 1.0) # still uses 'all.equal'

co2 = container(1L)
has(co2, 1.0)
has(co2, 1L)

container_options()
container_options(.reset = TRUE)
```

---

count *Count Elements*

Description

Count the number of occurences of some element.

Usage

```
count(x, elem)

## S3 method for class 'Container'
count(x, elem)

## S3 method for class 'Set'
count(x, elem)
```

Arguments

x	any R object.
elem	element to counted.

Value

integer number of how many times elem occurs in the object.

Examples

```
co = container("a", "b", "a", mean, mean)
count(co, "a")
count(co, mean)
count(co, "c")
```

delete *Delete Container Elements Safely*

Description

Search and remove elements from an object. If the element is not found, an error is signaled.

Usage

```
delete(.x, ...)

ref_delete(.x, ...)

## S3 method for class 'Container'
delete(.x, ...)

## S3 method for class 'Container'
ref_delete(.x, ...)
```

Arguments

.x	any R object.
...	elements to be deleted.

Value

For Container, an object of class Container (or one of the respective derived classes).

Examples

```
s = setnew("a", 1:3, iris)
print(s)
delete(s, 1:3, "a")
delete(s, iris)
try({
delete(s, "b")  # "b" is not in Set
})
```

delete_at *Delete Elements at Indices Safely*

Description

Search and remove values at given indices, which can be numeric or character or both. If any given index is invalid, an error is signaled. Indices can be numbers or names or both.

Usage

```
delete_at(.x, ...)

ref_delete_at(.x, ...)

## S3 method for class 'Container'
delete_at(.x, ...)

## S3 method for class 'Container'
ref_delete_at(.x, ...)

## S3 method for class 'dict.table'
delete_at(.x, ...)

## S3 method for class 'dict.table'
ref_delete_at(.x, ...)
```

Arguments

`.x`	any R object.
`...`	indices at which values are to be deleted.

Value

For `Container`, an object of class `Container` (or one of the respective derived classes).

For `dict.table`, an object of class `dict.table`.

Examples

```
co = container(a = 1, b = 2, 3)
delete_at(co, "a", "b")          # [3]
delete_at(co, 1:2)               # [3]
delete_at(co, "a", 3)            # [b = 2]
try({
delete_at(co, 4)                 # index out of range
delete_at(co, "x")               # names(s) not found: 'x'
})

dit = as.dict.table(head(sleep))
dit
delete_at(dit, "ID")
delete_at(dit, "ID", 1)
try({
 delete_at(dit, "foo")   # Column 'foo' not in dict.table
})
```

deprecated *Deprecated Functions*

Description

These functions are provided for backwards-compatibility and may be defunct as soon as the next release.

Usage

```
empty(x)

## S3 method for class 'Container'
empty(x)

size(x)

## S3 method for class 'Container'
size(x)

sortkey(x, decr = FALSE)

## S3 method for class 'Dict'
sortkey(x, decr = FALSE)

values(x)

## S3 method for class 'Container'
values(x)

## S3 method for class 'dict.table'
values(x)

keys(x)

set(...)
```

Arguments

x	any R object.
decr	logical sort decreasingly?
...	additional arguments.

Details

- empty() is_empty() instead

- set() setnew() instead
- size() use length() instead
- sortkey() keys of Dict objects are now always sorted
- remove() use delete() instead
- type() not of use anymore
- values() use as.list() instead

Deque *Deque Class*

Description

Deques are a generalization of stacks and queues typically with methods to add, delete and access elements at both sides of the underlying data sequence. As such, the Deque can also be used to mimic both stacks and queues. For the standard S3 interface, see deque().

Details

This class inherits from class Container() and extends it by popleft and peek methods, and reverse and rotate functionality.

Super classes

container::Iterable -> container::Container -> Deque

Methods

Public methods:

- Deque$addleft()
- Deque$peek()
- Deque$peekleft()
- Deque$popleft()
- Deque$rev()
- Deque$rotate()
- Deque$clone()

Method addleft(): Add element to left side of the Deque.

Usage:

```
Deque$addleft(value, name = NULL)
```

Arguments:

value value of ANY type to be added to the Deque.

name character optional name attribute of the value.

Returns: the Deque object.

Method `peek()`**:** Peek at last element of the `Deque`.

Usage:

```
Deque$peek(default = NULL)
```

Arguments:

`default` returned default value if `Deque` is empty.

Returns: element 'peeked' on the right

Method `peekleft()`**:** Peek at first element of the `Deque`.

Usage:

```
Deque$peekleft(default = NULL)
```

Arguments:

`default` returned default value if `Deque` is empty.

Returns: element 'peeked' on the left

Method `popleft()`**:** Delete and return element from the left side of the `Deque()`.

Usage:

```
Deque$popleft()
```

Returns: element 'popped' from the left side of the `Deque()`

Method `rev()`**:** Reverse all elements of the `Deque()` in-place.

Usage:

```
Deque$rev()
```

Returns: the `Deque()` object.

Method `rotate()`**:** Rotate all elements `n` steps to the right. If n is negative, rotate to the left.

Usage:

```
Deque$rotate(n = 1L)
```

Arguments:

`n integer` number of steps to rotate

Returns: returns the `Deque()` object.

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
Deque$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

See Also

`Container()`, `deque()`

Examples

```
d = Deque$new(1, 2, s = "a", v = 1:3)
d$addleft(0)
d$peekleft()
d$peek()

d$popleft()
d$rev()

d$rotate()
d$rotate(2)
d$rotate(-3)
```

DequeS3 *Deque - Double-Ended Queue*

Description

Deques are a generalization of stacks and queues typically with methods to add, remove and access elements at both sides of the underlying data sequence. As such, the deque can also be used to mimic both stacks and queues.

Usage

```
deque(...)

as.deque(x)

is.deque(x)
```

Arguments

...	initial elements put into the Deque.
x	R object of ANY type for as.deque() and is.deque() or of class Deque for the S3 methods.

Details

Methods that alter Deque objects usually come in two versions providing either copy or reference semantics where the latter start with 'ref_' to note the reference semantic, for example, add() and ref_add().

- deque(...) initializes and returns an object of class Deque
- as.deque(x) coerces x to a deque.
- is.deque(x) returns TRUE if x is of class Deque and FALSE otherwise.

- `x + y` combines `x` and `y` into a new deque by appending `y` to `x`.
- `x - y` element-wise removes all items of `y` from `x`, given the element was contained in `x`.
- `addleft(.x, ...)` adds (possibly named) elements to left side of `.x`.
- `ref_addleft(.x, ...)` same as `addleft(.x, ...)` but adds by reference.
- `peek(x, default = NULL)` peek at last element. If `x` is empty, return `default`.
- `peekleft(x, default = NULL)` peek at first element. If `x` is empty, return `default`.
- `ref_pop(.x)` pop last element. If `.x` is empty, an error is given.
- `ref_popleft(.x)` pop first element. If `.x` is empty, an error is given.
- `rev(x)` and `ref_rev(x)` reverses all elements being done on a copy or in place, respectively.
- `rotate(x, n)` rotate all elements `n` steps to the right, If `n` is negative, rotate to the left.

See Also

See `container()` for all inherited methods. For the full class documentation see `Deque()` and it's superclass Container().

Examples

```
d = deque(1, 2, s = "a", v = 1:3)
is.deque(d)
print(d)
length(d)
names(d)
as.list(d)
rev(d)

l = list(0, 1)
d2 = as.deque(l)
d + d2
c(d, d2) # same as d + d2
d2 + d
d - d2
c(d2, d) # same as d2 + d
d2 - d
# Math
d = deque(1, 2, -(3:5))
d
abs(d)
cumsum(d)
round(d)
exp(d)

# Summary
range(d)
min(d)
```

```
max(d)

d1 = deque(1, 1:2)
d2 = deque(2, 1:2)
d1 + d2     # same as c(d1, d2)
d2 + d1     # same as c(d2, d1)

d1 - d2
d2 - d1
d1 - d1


d = deque(0)
add(d, a = 1, b = 2)         # |0, a = 1, b = 2|
addleft(d, a = 1, b = 2)     # |b = 2, a = 1, 0|

d = deque(1, 2, 3)
peek(d)
peekleft(d)
peek(deque())
peek(deque(), default = 0)
peekleft(deque(), default = 0)
d = deque(1, 2, 3)
ref_pop(d)
print(d)
ref_popleft(d)
print(d)

try({
ref_pop(deque())  # pop at empty Deque
})

d = deque(a = 1, b = 2, 3)
rev(d)
print(d)
ref_rev(d)
print(d)

d = deque(1, 2, 3, 4)
rotate(d)
rotate(d, n = 2)
```

`Dict` *Dict Class*

Description

The `Dict()` resembles Python's dict type, and is implemented as a specialized associative `Container()`. For the standard S3 interface, see dict().

Details

This class inherits from class `Container()` and overwrides some methods to account for the associative key-value pair semantic. Internally, all key-value pairs are stored in a hash-table and the elements are always sorted lexicographically by their keys.

Super classes

`container::Iterable` -> `container::Container` -> `Dict`

Methods

Public methods:

- `Dict$new()`
- `Dict$add()`
- `Dict$discard_at()`
- `Dict$get()`
- `Dict$keys()`
- `Dict$remove()`
- `Dict$replace()`
- `Dict$set()`
- `Dict$sort()`
- `Dict$update()`
- `Dict$values()`
- `Dict$clone()`

Method `new()`**:** `Dict` constructor

Usage:

```
Dict$new(...)
```

Arguments:

`...` initial elements put into the `Dict`

Returns: returns the `Dict`

Method `add()`**:** If `name` not yet in `Dict`, insert `value` at `name`, otherwise signal an error.

Usage:

```
Dict$add(name, value)
```

Arguments:

`name` `character` variable name under which to store `value`.

`value` the value to be added to the `Dict`.

Returns: the `Dict` object

Method `discard_at()`**:** Discard value at given index. If index is not found, the operation is ignored.

Usage:

```
Dict$discard_at(index)
```

Arguments:

`index` `character` or `numeric` index

Returns: the `Dict` object

Method `get()`**:** This function is deprecated. Use `at2()` instead.

Usage:

```
Dict$get(key)
```

Arguments:

`key` `character` name of key.

Returns: If `key` in `Dict`, return value at `key`, else throw error.

Method `keys()`**:** Get all keys.

Usage:

```
Dict$keys()
```

Returns: `character` vector of all keys.

Method `remove()`**:** This function is deprecated. Use `delete()` instead.

Usage:

```
Dict$remove(key)
```

Arguments:

`key` `character` name of key.

Returns: If `key` in `Dict`, remove it, otherwise raise an error.

Method `replace()`**:** Replace one element by another element. Search for occurence of `old` and, if found, replace it by `new`. If `old` does not exist, an error is signaled.

Usage:

```
Dict$replace(old, new)
```

Arguments:

`old` element to be replaced

`new` element to be put instead of old

Returns: the `Dict` object

Method `set()`**:** This function is deprecated. Use `replace()` instead.

Usage:

```
Dict$set(key, value, add = FALSE)
```

Arguments:

`key` `character` name of key.

`value` the value to be set

`add` `logical` if `TRUE` the value is set regardless whether `key` already exists in `Dict`.

Returns: returns the `Dict`

Method `sort()`**:** Sort elements according to their keys. This function is deprecated as keys are now always sorted.

Usage:

```
Dict$sort(decr = FALSE)
```

Arguments:

`decr` `logical` if `TRUE` sort in decreasing order.

Returns: returns the `Dict`

Method `update()`**:** Add elements of `other` to this if the name is not in the `Dict` and update elements with existing names.

Usage:

```
Dict$update(other)
```

Arguments:

`other` `Iterable` object used to update this.

Returns: returns the updated `Dict` object.

Method `values()`**:** Get `Container` values

Usage:

```
Dict$values()
```

Returns: a copy of all elements in a list

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
Dict$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

See Also

`Container()`, `dict()`

Examples

```
d = Dict$new(o = "one", na = NA, a = 1)
d
d$keys()

d$add("li", list(1, 2))
d$discard_at("na")
d$replace(1, 9)

d2 = Dict$new(a = 0, b = 1)
d$update(d2)
```

`dict.table` *Combining Dict and data.table*

Description

The dict.table is a combination of dict and data.table and basically can be considered a data.table with unique column names and an extended set of functions to add, extract and remove data columns with the goal to further facilitate code development using data.table. A dict.table object provides all dict and data.table functions and operators at the same time.

Usage

```
dict.table(...)

as.dict.table(x, ...)

## S3 method for class 'data.table'
as.dict.table(x, copy = TRUE, ...)

is.dict.table(x)

## S3 method for class 'dict.table'
rbind(x, ...)

## S3 method for class 'dict.table'
cbind(x, ...)
```

Arguments

`...`	elements put into the dict.table and/or additional arguments to be passed on.
`x`	any `R` object or a dict.table object.
`copy`	if `TRUE` creates a copy of the `data.table` object otherwise works on the passed object by reference.

Details

Methods that alter dict.table objects usually come in two versions providing either copy or reference semantics where the latter start with `'ref_'` to note the reference semantic, for example, `add()` and `ref_add()`.

- `dict.table(...)` initializes and returns a dict object.
- `as.dict.table(x, ...)` coerce `x` to a dict.table
- `is.dict.table(x)` check if `x` is a `dict.table`
- `add(.x, ...)` and `ref_add(.x, ...)` add columns to `.x`. If the column name already exists, an error is given.

- `at(.x, ...)` returns the columns at the given indices. Indices can be letters or numbers or both. All columns must exist.
- `at2(x, index)` returns the column at the given `index` or signals an error if not found.
- `clear(x)` and `ref_clear(x)` remove all elements from `x`.
- `clone(x)` create a copy of `x`.
- `delete_at(.x, ...)` and `ref_delete_at(.x, ...)` find and remove columns either by name or index (or both). If one or more columns don't exist, an error is signaled.
- `discard_at(.x, ...)` and `ref_discard_at(.x, ...)` find and remove columns either by name or index (or both). Invalid column indices are ignored.
- `has(x, column)` check if some `column` is in dict.table object.
- `has_name(x, name)` check if `x` has the given column name.
- `is_empty(x)` `TRUE` if object is empty otherwise `FALSE`
- `peek_at(x, ..., .default = NULL)` returns the columns at the given indices or (if not found) columns with the given default value.
- `peek_at2(x, index, default = NULL)` return column named `index` if it exist otherwise the given `default` value. If the default length does not match the number of rows, it is recycled accordingly and a warning is given, unless the default value has a length of 1, in which case recycling is done silently.
- `ref_pop(.x, index)` return element at given column index and remove the column from the dict.table object.
- `rename(.x, old, new)` and `ref_rename(.x, old, new)` rename one or more columns from `old` to `new`, respectively, by copy and in place (i.e. by reference).
- `replace_at(.x, .., .add = FALSE)` and `ref_replace_at(.x, ..., .add = FALSE)` replace values at given indices. If a given index is invalid, an error is signaled unless `.add` was set to `TRUE`.
- `update(object, other)` and `ref_update(object, other)` adds columns of `other` dict that are not yet in `object` and replaces the values at existing columns.

See Also

dict, data.table

Examples

```
# Some basic examples using some typical data.table and dict operations.
# The constructor can take the 'key' argument known from data.table:
require(data.table)
dit = dict.table(x = rep(c("b","a","c"), each = 3), y = c(1,3,6), key = "y")
print(dit)
setkey(dit, "x")                            # sort by 'x'
print(dit)
(add(dit, "v" = 1:9))                       # add column v = 1:9
dit[y > 5]
(ref_discard_at(dit, "x"))                  # discard column 'x'

try(at(dit, "x"))                           # index 'x' not found
try(replace_at(dit, x = 0))                 # cannot replace non-existing x

dit = replace_at(dit, x = 0, .add = TRUE)   # re-adds column 'x' with all 0s
peek_at(dit, "x")                           # glance at column 'x'
has_name(dit, "x")                          # TRUE
ref_pop(dit, "x")                           # get column and remove it
has_name(dit, "x")                          # FALSE


# Copy and reference semantics when coercing *from* a data.table
dat = data.table(a = 1, b = 2)
dit = as.dict.table(dat)
is.dict.table(dit)                          # TRUE
is.dict.table(dat)                          # FALSE
ref_replace_at(dit, "a", 9)
dit[["a"]]                                  # 9
dat[["a"]]                                  # 1
dit.dat = as.dict.table(dat, copy = FALSE)  # init by reference
ref_replace_at(dit.dat, "a", 9)
dat[["a"]]                                  # 9
is.dict.table(dit.dat)                      # TRUE
is.dict.table(dat)                          # TRUE now as well!

# Coerce from dict
d = dict(a = 1, b = 1:3)
as.dict.table(d)

dit = dict.table(a = 1:2, b = 1:2)
rbind(dit, dit)

# rbind ...
dit = dict.table(a = 1:2, b = 1:2)
rbind(dit, dit)

# ... can be mixed with data.tables
dat = data.table(a = 3:4, b = 3:4)
rbind(dit, dat)  # yields a dict.table
rbind(dat, dit)  # yields a data.table
```

```
# cbind ...
dit = dict.table(a = 1:2, b = 1:2)
dit2 = dict.table(c = 3:4, d = 5:6)
cbind(dit, dit2)

# ... can be mixed with data.tables
dat = data.table(x = 3:4, y = 3:4)
cbind(dit, dat)

dit = dict.table(a = 1:3)
add(dit, b = 3:1, d = 4:6)

try(add(dit, a = 7:9))  # column 'a' already exists

dit = dict.table(a = 1:3, b = 4:6)
at(dit, "a")
at(dit, 2)
at(dit, "a", 2)
try(at(dit, "x"))     # index 'x' not found
try(at(dit, 1:3))     # index 3 exceeds length of dict.table

dit = dict.table(a = 1:3, b = 4:6)
at2(dit, 1)
at2(dit, "a")
at2(dit, 2)
try(at2(dit, "x"))     # index 'x' not found
try(at2(dit, 5))       # index 5 exceeds length of dict.table

dit = dict.table(a = 1, b = 2)
clear(dit)
dit
ref_clear(dit)
dit

d = dict.table(a = 1:2, b = 3:4)
d2 = clone(d)
ref_clear(d)
print(d2)

(dit = as.dict.table(head(sleep)))
delete_at(dit, "ID")
delete_at(dit, "ID", 1)

try({
delete_at(dit, "foo")   # Column 'foo' not in dict.table
})

dit = as.dict.table(head(sleep))
discard_at(dit, "ID")
discard_at(dit, "ID", 1)
discard_at(dit, "foo")  # ignored

dit = dict.table(a = 1:3, b = as.list(4:6))
```

```
has(dit, 1:3)            # TRUE
has(dit, 4:6)            # FALSE
has(dit, as.list(4:6))   # TRUE

dit = dict.table(a = 1, b = 2)
has_name(dit, "a")    # TRUE
has_name(dit, "x")    # FALSE

d = dict.table(a = 1:4, b = 4:1)
is_empty(d)
is_empty(clear(d))

dit = dict.table(a = 1:3, b = 4:6)
peek_at(dit, "a")
peek_at(dit, 1)
peek_at(dit, 3)
peek_at(dit, "x")
peek_at(dit, "x", .default = 0)
peek_at(dit, "a", "x", .default = 0)

dit = dict.table(a = 1:3, b = 4:6)
peek_at2(dit, "a")
peek_at2(dit, 1)
peek_at2(dit, 3)
peek_at2(dit, 3, default = 9)
peek_at2(dit, "x")
peek_at2(dit, "x", default = 0)

dit = dict.table(a = 1:3, b = 4:6)
ref_pop(dit, "a")
ref_pop(dit, 1)

try({
ref_pop(dit, "x")  # index 'x' not found
})

dit = dict.table(a = 1, b = 2, c = 3)
rename(dit, c("a", "b"), c("a1", "y"))
print(dit)
ref_rename(dit, c("a", "b"), c("a1", "y"))
print(dit)

dit = dict.table(a = 1:3)
replace_at(dit, "a", 3:1)

try({
replace_at(dit, "b", 4:6)               # column 'b' not in dict.table
})
replace_at(dit, "b", 4:6, .add = TRUE)  # ok, adds column

# Update parts of tables (second overwrites columns of the first)
dit1 = dict.table(a = 1:2, b = 3:4)
dit2 = dict.table(         b = 5:6, c = 8:9)
```

```
update(dit1, dit2)
update(dit2, dit1)
```

DictS3 *A Dictionary*

Description

The Dict initially was developed to resemble Python's dict type, but by now offers both more features and flexibility, for example, by providing both associative key-value pair as well as positional array semantics. It is implemented as a specialized associative Container thus sharing all Container methods with some of them being adapted to account for the key-value pair semantic. All elements must be named.

Usage

```
dict(...)

as.dict(x)

is.dict(x)
```

Arguments

`...`	elements put into the `Dict`.
`x`	`R` object of `ANY` type for `as.dict()` and `is.dict()` or of class `Dict` for the `S3` methods.

Details

Internally, all key-value pairs are stored in a hash-table and the elements are sorted lexicographically by their keys. Methods that alter `Dict` objects usually come in two versions providing either copy or reference semantics where the latter start with `'ref_'` to note the reference semantic, for example, `add()` and `ref_add()`.

- `dict(...)` initializes and returns an object of class `Dict`
- `as.dict(x)` coerces `x` to a dictionary
- `is.dict(x)` returns `TRUE` if `x` is of class `Dict` and `FALSE` otherwise.
- `x + y` combines `x` and `y` into a new dict by updating `x` by `y` (see also `[update()]`).
- `x - y` removes all keys from `x` that appear in `y`.
- `x & y` returns a copy of `x` keeping only the keys that are common in both (key intersection), that is, all keys in `x` that do not exist in `y` are removed.

- `x | y` returns a copy of `x` extended by all elements of `y` that are stored at keys (or names) that do not exist in `x`, thereby combining the keys of both objects (set union of keys).
- `add(.x, ...)` and `ref_add(.x, ...)` adds `key = value` pairs to `.x`. If any of the keys already exists, an error is given.
- `replace(.x, old, new)` and `ref_replace(.x, old)` try to find element `old` and replace it with element `new`. If `old` does not exist, an error is raised.
- `update(object, other)` and `ref_update(object, other)` adds elements of `other` dict for keys not yet in `object` and replaces the values of existing keys.

See Also

See `container()` for all inherited methods. For the full class documentation see Dict and it's superclass Container.

Examples

```
d = dict(b = "one", a = 1, f = mean, na = NA)
print(d)
names(d)

try(dict(a = 1, 2))   # all elements must be named

# Coercion
as.dict(list(A = 1:3, B = "b"))
as.dict(c(x = 1, y = "x", z = 2 + 3))
# Math
d = dict(a = rnorm(1), b = rnorm(1))
abs(d)
cumsum(d)
round(d)
exp(d)

# Summary
range(d)
min(d)
max(d)

d1 = dict(a = 1, b = list(1, 2))
d2 = dict(a = 2, b = list(1, 2))
d1 + d2      # same as update(d, d2)
d2 + d1      # same as update(d2, d)
try({
c(d1, d2)    # duplicated keys are not allowed for Dict
})
d1 - d2
d2 - d1
d1 - d1

d1 = dict(a = 1, b = 2)
```

```
d2 = dict(a = 10, x = 4)
d1 & d2      # {a = 1}

d1 | d2      # {a = 1, b = 2, x = 4}


d = dict(a = 1)
add(d, b = 2, co = container(1:3))

try(add(d, a = 7:9))  # key 'a' already in Dict

d = dict(a = 1, b = "z")
replace(d, 1, 1:5)
replace(d, "z", "a")

try({
replace(d, "a", 2)              # old element ("a") is not in Dict
})

d1 = dict(a = 1, b = 2)
d2 = dict(       b = 0, c = 3)
update(d1, d2)  # {a = 1, b = 0, c = 3}
update(d2, d1)  # {a = 1, b = 2, c = 3}
```

`discard` *Discard Container Elements*

Description

Search and remove an element from an object. If the element is not found, ignore the attempt.

Usage

```
discard(.x, ...)

ref_discard(.x, ...)

## S3 method for class 'Container'
discard(.x, ...)

## S3 method for class 'Container'
ref_discard(.x, ...)
```

Arguments

`.x`	any R object.
`...`	elements to be discarded.

Value

For `Container`, an object of class `Container` (or one of the respective derived classes).

Examples

```
s = setnew("a", num = 1:3, data = iris)
print(s)
discard(s, 1:3, "a")
discard(s, iris)
discard(s, "b")  # ignored
```

`discard_at` *Discard Elements at Indices*

Description

Search and remove values at given indices, which can be numeric or character or both. Invalid indices are ignored.

Usage

```
discard_at(.x, ...)

ref_discard_at(.x, ...)

## S3 method for class 'Container'
discard_at(.x, ...)

## S3 method for class 'Container'
ref_discard_at(.x, ...)

## S3 method for class 'dict.table'
discard_at(.x, ...)

## S3 method for class 'dict.table'
ref_discard_at(.x, ...)
```

Arguments

`.x`	any R object.
`...`	indices at which values are to be discarded.

Value

For `Container`, an object of class `Container` (or one of the respective derived classes).

For `dict.table`, an object of class `dict.table`.

Examples

```
co = container(a = 1, b = 2, 3)
discard_at(co, "a", "b")         # [3]
discard_at(co, 1:2)              # [3]
discard_at(co, "a", 3)           # [b = 2]
discard_at(co, "x")              # ignored

dit = as.dict.table(head(sleep))
discard_at(dit, "ID")
discard_at(dit, "ID", 1)
discard_at(dit, "foo")  # ignored
```

---

has *Check for Element*

Description

Check for Element

Usage

```
has(x, ...)

## S3 method for class 'Container'
has(x, elem, ...)

## S3 method for class 'dict.table'
has(x, column, ...)
```

Arguments

x	any R object.
...	additional arguments to be passed to or from methods.
elem	some element to be found.
column	vector of values with the same length as the number of rows of the dict.table.

Value

TRUE if element is in x and otherwise FALSE.

For dict.table, TRUE if column exists in x otherwise FALSE.

See Also

has_name()

Examples

```
co = container(1, 2, mean)
has(co, 1)                  # TRUE
has(co, mean)               # TRUE
has(co, 1:2)                # FALSE

dit = dict.table(a = 1:3, b = as.list(4:6))
has(dit, 1:3)            # TRUE
has(dit, 4:6)            # FALSE
has(dit, as.list(4:6))   # TRUE
```

---

has_name *Check for Name*

Description

Check for Name

Usage

```
has_name(x, name)

## S3 method for class 'Container'
has_name(x, name)

## S3 method for class 'dict.table'
has_name(x, name)
```

Arguments

x	any R object.
name	character the name to be found.

Value

TRUE if name is in x and otherwise FALSE.

For dict.table TRUE if the dict.table objects has the given column name, otherwise FALSE.

See Also

has()

Examples

```
co = container(a = 1, 2, f = mean)
has_name(co, "a")    # TRUE
has_name(co, "f")    # TRUE
has_name(co, "2")    # FALSE

dit = dict.table(a = 1:2, b = 3:4)
has_name(dit, "a")   # TRUE
has_name(dit, "x")   # FALSE
```

---

is_empty *Check if Object is Empty*

Description

Check if Object is Empty

Usage

```
is_empty(x)

## S3 method for class 'Container'
is_empty(x)

## S3 method for class 'dict.table'
is_empty(x)
```

Arguments

x	any R object.

Value

TRUE if object is empty otherwise FALSE.

Examples

```
co = container(1, 2)
is_empty(co)
is_empty(clear(co))

d = dict.table(a = 1:4, b = 4:1)
is_empty(d)
is_empty(clear(d))
```

`Iterable` *Iterable abstract class interface*

Description

An Iterable is an object that provides an `iter()` method, which is expected to return an Iterator object. This class defines the abstract class interface such that each class inheriting this class provides an `iter()` method and must implement a private method `create_iter()`, which must return an Iterator object.

Methods

Public methods:

- `Iterable$new()`
- `Iterable$iter()`
- `Iterable$clone()`

Method `new()`**:** `Iterable` is an abstract class and thus cannot be instantiated.

Usage:

```
Iterable$new()
```

Method `iter()`**:** Create iterator

Usage:

```
Iterable$iter()
```

Returns: returns the `Iterator` object.

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
Iterable$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Author(s)

Roman Pahl

See Also

Iterator and Container

Iterator *Iterator Class*

Description

An Iterator is an object that allows to iterate over sequences. It implements next_iter and get_value to iterate and retrieve the value of the sequence it is associated with. For the standard S3 interface, see iter().

Methods

Public methods:

- Iterator$new()
- Iterator$begin()
- Iterator$get_value()
- Iterator$get_next()
- Iterator$has_next()
- Iterator$has_value()
- Iterator$length()
- Iterator$pos()
- Iterator$next_iter()
- Iterator$print()
- Iterator$reset_iter()
- Iterator$clone()

Method new(): Iterator constructor

Usage:

```
Iterator$new(x, .subset = .subset2)
```

Arguments:

x object to iterate over

.subset accessor function

Returns: invisibly returns the Iterator object

Method begin(): set iterator to the first element of the underlying sequence unless length of sequence is zero, in which case it will point to nothing.

Usage:

```
Iterator$begin()
```

Returns: invisibly returns the Iterator object

Method get_value(): get value where the iterator points to

Usage:

```
Iterator$get_value()
```

Returns: returns the value the `Iterator` is pointing at.

Method `get_next()`**:** get next value

Usage:

```
Iterator$get_next()
```

Returns: increments the iterator and returns the value the `Iterator` is pointing to.

Method `has_next()`**:** check if `iterator` has more elements

Usage:

```
Iterator$has_next()
```

Returns: `TRUE` if `iterator` has next element else `FALSE`

Method `has_value()`**:** check if `iterator` points at value

Usage:

```
Iterator$has_value()
```

Returns: `TRUE` if `iterator` points at value otherwise `FALSE`

Method `length()`**:** iterator length

Usage:

```
Iterator$length()
```

Returns: number of elements to iterate

Method `pos()`**:** get iterator position

Usage:

```
Iterator$pos()
```

Returns: `integer` if `iterator` has next element else `FALSE`

Method `next_iter()`**:** increment `iterator`

Usage:

```
Iterator$next_iter()
```

Returns: invisibly returns the `Iterator` object

Method `print()`**:** print method

Usage:

```
Iterator$print()
```

Method `reset_iter()`**:** reset iterator to '0'

Usage:

```
Iterator$reset_iter()
```

Returns: invisibly returns the `Iterator` object

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
Iterator$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

Author(s)

Roman Pahl

Examples

```
# Numeric Vector
v = 1:3
it = Iterator$new(v)
it

try(it$get_value())  # iterator does not point at a value

it$has_value()
it$has_next()
it$next_iter()
it$get_value()
it$get_next()
it$get_next()
it
it$has_next()
it$begin()
it$get_value()
it$reset_iter()

# Works by reference for Container
co = Container$new(1, 2, 3)
it = co$iter()
it$get_next()
co$discard(2)
it
it$get_value()
co$discard(1)
it
it$get_value()
it$begin()
```

`iterS3` *Iterate over Sequences*

Description

An `Iterator` is an object that allows to iterate over sequences. It implements `next_iter()` and `get_value()` to iterate and retrieve the value of the sequence it is associated with. For documentation of the methods see Iterator.

Usage

```
iter(x, ...)
```

```
## S3 method for class 'Container'
iter(x, ...)

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

is.iterator(x)

is.iterable(x)

begin(it)

get_value(it)

get_next(it)

has_next(it)

has_value(it)

## S3 method for class 'Iterator'
length(x)

pos(it)

next_iter(it)

reset_iter(it)
```

Arguments

x	an object of class Iterable or any other R object. In the latter case, x will always be coerced to a base R list prior to creating the Iterator.
...	other parameters passed to or from methods
it	Iterator object

Value

length returns the number of elements that can be iterated over.

See Also

For the class documentation see Iterator.

Examples

```
# Numeric Vector
v = 1:3
it = iter(v)
```

```
it

try(it$get_value())  # iterator does not point at a value

has_value(it)
has_next(it)
next_iter(it)
get_value(it)
get_next(it)
get_next(it)
it
has_next(it)
begin(it)
get_value(it)
reset_iter(it)

# Works on copy of Container
co = container(1, 2, 3)
it = iter(co)
get_next(it)
ref_discard(co, 2)
co
it
get_next(it)
ref_clear(co)
co
it
get_next(it)
begin(it)
```

OpsArithmetic *Arithmetic Operators*

Description

Binary arithmetic operators for `Container()` objects and derived classes.

Usage

```
## S3 method for class 'Container'
x + y

## S3 method for class 'Container'
x - y

## S3 method for class 'Deque'
x + y

## S3 method for class 'Deque'
```

```
x - y

## S3 method for class 'Dict'
x + y

## S3 method for class 'Dict'
x - y

## S3 method for class 'Set'
x + y

## S3 method for class 'Set'
x - y
```

Arguments

x, y	Depending on the operator at least one must be of class `Container()` or the respective derived class and the other at least be coercible to the respective class.

Value

For `Container`, `x + y` combines `x` and `y` into a new container by appending `y` to `x`.

For Container, `x - y` element-wise discards all items of `y` from `x`, given the element was contained in `x`. The result is always a container.

For `Deque`, `x + y` combines `x` and `y` into a new deque by appending `y` to `x`.

For Deque, `x - y` element-wise removes all items of `y` from `x`, given the element was contained in `x`.

For `Dict`, `x + y` combines `x` and `y` into a new dict by updating `x` by `y` (see also `[update()]`).

For `Dict`, `x - y` removes all keys from `x` that appear in `y`.

For `Set`, `x + y` performs the set union.

For `Set`, `x - y` performs the set difference.

Examples

```
c1 = container(1, 1:2)
c2 = container(2, 1:2)
c1 + c2     # same as c(c1, c2)
c2 + c1     # same as c(c2, c1)

c1 - c2
c2 - c1
c1 - c1
# Arithmetic
d1 = deque(1, 1:2)
d2 = deque(2, 1:2)
d1 + d2     # same as c(d1, d2)
d2 + d1     # same as c(d2, d1)

d1 - d2
```

```
d2 - d1
d1 - d1

# Arithmetic
d1 = dict(a = 1, b = list(1, 2))
d2 = dict(a = 2, b = list(1, 2))
d1 + d2      # same as update(d, d2)
d2 + d1      # same as update(d2, d)
try({
c(d1, d2)    # duplicated keys are not allowed for Dict
})
d1 - d2
d2 - d1
d1 - d1

# Arithmetic
s1 = setnew(1, 1:2)
s2 = setnew(2, 1:2)
s1 + s2     # same as s1 | s2 or c(c1, s2)
s2 + s1     # same

s1 - s2
s2 - s1
```

`OpsCompare` *Comparison Operators*

Description

Binary comparison operators for `Container()` objects and derived classes.

Usage

```
## S3 method for class 'Container'
x == y

## S3 method for class 'Container'
x != y

## S3 method for class 'Container'
x < y

## S3 method for class 'Container'
x > y

## S3 method for class 'Container'
x <= y
```

```
## S3 method for class 'Container'
x >= y
```

Arguments

x, y	at least one must be a `Container()` object (or an object of one of the derived classes) while the other must be at least iterable.

Details

- `x == y` is `TRUE` if the contents of `x` and `y` are lexicographically *equal*.
- `x != y` is `TRUE` if the contents of `x` and `y` are *not equal*.
- `x < y` is `TRUE` if the contents of x are lexicographically *less* than the contents of y.
- `x <= y` is `TRUE` if the contents of x are lexicographically *less* than or *equal* to the contents of y.

Examples

```
c1 = container(1, 2, 3)
c2 = container(1, 3, 2)
c1 == c1            # TRUE
c1 != c2            # TRUE
c1 <= c1            # TRUE
c1 == c2            # FALSE
c1 < c2             # TRUE
c1 < container(2)   # TRUE
c1 < container()    # FALSE
```

`OpsExtract` *Extract Parts of a Container*

Description

Operators that extract parts of a `Container`. The behavior is similar to base R lists and includes convenient extensions for interactive work.

Usage

```
## S3 method for class 'Container'
x[i, ..., .default = NULL]

## S3 method for class 'Container'
x[[i]]
```

Arguments

x	A Container from which to extract elements.
i, ...	Indices specifying elements to extract. Indices may be numeric, character, logical, NULL, or empty. Logical vectors are recycled as needed. Negative integers drop by position. Negative character indices drop by name. Range expressions such as a:b, 1:c, or d:2 are supported for convenience and are resolved in the calling environment.
.default	A value used to fill missing items when extracting. If given, unknown names and out-of-bounds positive indices are kept and filled with this value.

Details

The [operator selects one or more elements and returns a Container. Order is preserved and duplicates are kept. Logical indices recycle to the container length with a warning when lengths do not match. NA in logical indices is treated as FALSE with a warning. Positive and negative numeric indices cannot be mixed in a single call and will raise an error. Out-of-bounds negative indices are ignored. Character indices match names. Unknown names are ignored unless .default is supplied, in which case they are kept and filled. Comma-separated indices and list(...) are accepted and behave like a single combined index.

The [[operator selects a single element and returns the value or NULL if the element is not present.

Value

For [a Container. For [[the extracted value or NULL.

Warning

Range expressions such as x[a:b] are intended for interactive use, where the resulting indices can be easily inspected and corrected by the user. They are convenient for quick exploration and data analysis, but *not* intended for programming, where explicit indices should be used instead to avoid unexpected results.

See Also

peek_at for lenient extraction with defaults, at and at2 for strict programmatic access, and base [, [[, and $ for general indexing semantics.

Examples

```
co <- container(a = 1, b = 2, c = 3, d = 4)

# Numeric
co[c(1, 4)]                          # [a = 1, d = 4]
co[1, 4]                             # same (comma-sugar)
co[1, 1]                             # duplicates kept -> [a = 1, a = 1]
co[0:5]                              # unknowns ignored -> [a = 1, b = 2, c = 3, d = 4]
co[5]                                # [] (unknown positive index)

# Negative numeric
```

```
co[-c(1:2)]                          # [c = 3, d = 4]
co[-1, -4]                           # [b = 2, c = 3]
try(co[-1, 3])                       # error: cannot mix positive & negative
co[-5]                               # out-of-bounds negatives ignored -> full container

# Character
co[c("a", "d")]                      # [a = 1, d = 4]
co["a", "d"]                         # same
co[letters[1:5]]                   # unknown names dropped -> [a = 1, b = 2, c = 3, d = 4]
co["x"]                              # []

# Negative character (drop by name)
co[-c("a", "d")]                     # [b = 2, c = 3]
co[-"a", -"d"]                       # [b = 2, c = 3]

# Logical
co[c(TRUE, FALSE, TRUE, FALSE)]      # [a = 1, c = 3]
co[TRUE, FALSE]                      # [a = 1, c = 3] (recycled)
co[c(TRUE, NA)]                      # [a = 1, c = 3] (NA -> FALSE, warning)

# Mixed numeric and character
co[list(1, "d")]                     # [a = 1, d = 4]
co[1, "d"]                           # same

# Alphanumeric ranges (NSE)
co[a:b]                              # [a = 1, b = 2]
co[a:b, d:c]                         # [a = 1, b = 2, d = 4, c = 3]
co[1:c]                              # [a = 1, b = 2, c = 3]
co[d:2]                              # [d = 4, c = 3, b = 2]
co[-(a:c)]                           # [d = 4]

# Default-filling of missing items
co[1:5, 0, .default = 0]             # [a = 1, b = 2, c = 3, d = 4, 0]
co["a", "b", "z", .default = 0]      # [a = 1, b = 2, z = 0]
co[1:2, "z", .default = 3:4]         # [a = 1, b = 2, z = (3L 4L)]


co = container(a = 1, b = 2)
co[[1]]
co[["a"]]
co[["x"]]
```

OpsLogic *Logic Operators*

Description

Binary logic operators for `Container()` objects and derived classes.

Usage

```
## S3 method for class 'Dict'
x & y

## S3 method for class 'Dict'
x | y

## S3 method for class 'Set'
x & y

## S3 method for class 'Set'
x | y
```

Arguments

x, y	Depending on the operator at least one must be of class `Container()` or the respective derived class and the other at least be coercible to the respective class.

Examples

```
d1 = dict(a = 1, b = 2)
d2 = dict(a = 10, x = 4)
d1 & d2      # {a = 1}
```

OpsReplace *Replace Parts of a Container*

Description

Replace parts of a `Container` object similar to R's base list replacement operators, with extended indexing options matching extraction.

Usage

```
## S3 replacement method for class 'Container'
x[i, ...] <- value

## S3 replacement method for class 'Container'
x[[i]] <- value

## S3 replacement method for class 'Container'
x$name <- value
```

Arguments

x	Container object in which to replace elements.
i, ...	Indices specifying elements to replace. Indices may be numeric, character, logical, NULL, or empty. Logical vectors are recycled as needed. Negative integers and negative character tokens select the complement (i.e., drop-by-position or drop-by-name) and the resulting kept positions are replaced. Range expressions such as a:b, 1:c, or d:2 are supported for convenience and are resolved in the calling environment (non-standard evaluation). Comma-separated indices and list(...) are accepted and behave like a single combined index.
value	the replacing value of ANY type
name	character string (possibly backtick quoted)

Details

- [<- replaces multiple values. Indices can be numeric, character, logical, or a list combining them, including NSE ranges as in extraction. Unknown character indices add new elements (equivalent to .add = TRUE). Numeric indices must be within bounds and will error if out of range. Using an empty index x[] <- v targets all positions. Zero-length selections (e.g., integer(0)) perform no replacement.
- [[<- replaces a single value at a given numeric or character index. Instead of an index, it is also possible to replace certain elements by passing the element in curly braces (see Examples), that is, the object is searched for the element and then the element is replaced by the value.
- $<- replaces a single element at a given name.

Examples

```
co = container(a = 1, b = "bar")
(co[1:2] <- 1:2)

try({
co[3] <- 3 # index out of range
})
(co[list(1, "b")] <- 3:4)   # mixed numeric/character index

co = container(a = 1, b = 2)
co[[1]] <- 9
co[["b"]] <- 8
co[["x"]] <- 7
co$z <- 99
print(co)

# Replace 8 by 0
co[[{8}]] <- 0
print(co)


co = container(a = 1, b = "bar")
co$f <- 3
co$b <- 2
```

co

OrderedSet *OrderedSet Class*

Description

The OrderedSet is a Set where all elements are always ordered.

Details

The order of elements is determined sequentially as follows:

- element's length
- whether it is an atomic element
- the element's class(es)
- by numeric value (if applicable)
- it's representation when printed
- the name of the element in the Set

Super classes

`container::Iterable` -> `container::Container` -> `container::Set` -> `OrderedSet`

Methods

Public methods:

- `OrderedSet$new()`
- `OrderedSet$add()`
- `OrderedSet$clone()`

Method `new()`**:** `OrderedSet` constructor

Usage:

```
OrderedSet$new(...)
```

Arguments:

`...` initial elements put into the `OrderedSet`

Returns: returns the `OrderedSet` object

Method `add()`**:** Add element

Usage:

```
OrderedSet$add(value, name = NULL)
```

Arguments:

`value` value of `ANY` type to be added to the `OrderedSet`.

`name` `character` optional name attribute of the value.

Returns: the `OrderedSet` object.

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
OrderedSet$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

See Also

Container, Set

Examples

```
s1 = OrderedSet$new(2, 1)
s1
```

---

peek *Peek at Left or Right of a Deque*

Description

Try to access first or last element and return some default value if not found. In contrast to `[at2()]`, this function provides a less stricter element access, that is, it remains valid even if peeked elements don't exist.

Usage

```
peekleft(x, default = NULL)

peek(x, default = NULL)

## S3 method for class 'Deque'
peek(x, default = NULL)

## S3 method for class 'Deque'
peekleft(x, default = NULL)
```

Arguments

`x`	a Deque object.
`default`	value to be returned if peeked value does not exist.

Details

peek peek at last element of a Deque.

peekleft peek at first element of a Deque.

Value

The first (peekleft) or last (peek) element.

See Also

at2() for strict element extraction

Examples

```
# Deque
d = deque(1, 2, 3)
peek(d)
peekleft(d)
peek(deque())
peek(deque(), default = 0)
peekleft(deque(), default = 0)
```

---

peek_at *Peek at Indices*

Description

Try to access elements and return default values if not found. In contrast to [at()], this function provides a less stricter element access, that is, it remains valid even if elements don't exist.

Usage

```
peek_at(.x, ...)

## S3 method for class 'Container'
peek_at(.x, ..., .default = NULL)

## S3 method for class 'dict.table'
peek_at(.x, ..., .default = NULL)
```

Arguments

.x	an R object of the respective class.
...	indices of elements to be extracted
.default	value to be returned if peeked value does not exist.

Details

peek_at tries to access specific values.

Value

For Container, returns the value at the given indices or (if not found) the given default value.

For dict.table, returns the columns at the given indices or (if not found) columns with the given default value.

See Also

at() for strict element extraction

Examples

```
# Container
co = container(a = 1, 2, b = 3, 4)
peek_at(co, 1)
peek_at(co, "a")
peek_at(co, "x")
peek_at(co, "x", .default = 0)
peek_at(co, "a", "x", 2, 9, .default = -1)

# Dict
d = dict(a = 1, b = 1:3)
peek_at(d, "b")
peek_at(d, "x")
peek_at(d, "x", .default = 4:7)

# dict.table
dit = dict.table(a = 1:3, b = 4:6)
peek_at(dit, "a")
peek_at(dit, 1)
peek_at(dit, 3)
peek_at(dit, "x")
peek_at(dit, "x", .default = 0)
peek_at(dit, "a", "x", .default = 0)
```

---

peek_at2 *Peek at Single Index*

Description

Try to access element and return some default value if not found. In contrast to [at2()], this function provides a less stricter element access, that is, it remains valid even if peeked elements don't exist.

Usage

```
peek_at2(x, index, default = NULL)

## S3 method for class 'Container'
peek_at2(x, index, default = NULL)

## S3 method for class 'dict.table'
peek_at2(x, index, default = NULL)
```

Arguments

x	an R object of the respective class.
index	character name or numeric position of the sought value.
default	value to be returned if peeked value does not exist.

Value

For Container, returns the value at the given index or (if not found) the given default value.

For dict.table, returns the column named index if it exist otherwise the given default value. If the default length does not match the number of rows, it is recycled accordingly and a warning is given, unless the default value has a length of 1, in which case recycling is done silently.

See Also

at2() for strict element extraction

Examples

```
# Container
co = container(a = 1, 2, b = 3, 4)
peek_at2(co, 1)
peek_at2(co, "a")
peek_at2(co, "x")
peek_at2(co, "x", default = 0)

# Dict
d = dict(a = 1, b = 1:3)
peek_at2(d, "b")
peek_at2(d, "x")
peek_at2(d, "x", default = 4:7)

# dict.table
dit = dict.table(a = 1:3, b = 4:6)
peek_at2(dit, "a")
peek_at2(dit, 1)
peek_at2(dit, 3)
peek_at2(dit, 3, default = 9)
peek_at2(dit, "x")
peek_at2(dit, "x", default = 0)
```

pop *Get and Remove Element*

Description

Search and return an element and remove it afterwards from the object. If the element is not found, signal an error.

Usage

```
ref_pop(.x, ...)

ref_popleft(.x, ...)

## S3 method for class 'Deque'
ref_pop(.x, ...)

## S3 method for class 'Deque'
ref_popleft(.x, ...)

## S3 method for class 'Container'
ref_pop(.x, index, ...)

## S3 method for class 'dict.table'
ref_pop(.x, index, ...)
```

Arguments

`.x`	any R object.
`...`	additional arguments to be passed to or from methods.
`index`	`character` name or `numeric` position of value to be popped

Details

All functions work by reference, that is, the original object is altered. `ref_pop(.x)` tries to access specific values.

`ref_popleft(.x)` pops first element of a `Deque`.

Value

For `Deque` the first (`ref_popleft`) or last (`ref_pop`) element of the deque after it was removed.

For `Container` the value at the given index after it was removed from the `Container` object. If `index` is not found, an error is raised.

For `dict.table`, returns the column at the given `index` after it was removed from the `dict.table`. If column does not exist, an error is raised.

See Also

peek()

Examples

```
# Deque
d = deque(1, 2, 3)
ref_pop(d)
ref_popleft(d)

try({
ref_pop(deque())  # pop at empty Deque
})

# Container
co = container(a = 1, b = 1:3, d = "foo")
ref_pop(co, "b")
ref_pop(co, 1)

try({
ref_pop(co, "x")  # index 'x' not found
})

# dict.table
dit = dict.table(a = 1:3, b = 4:6)
ref_pop(dit, "a")
ref_pop(dit, 1)

try({
ref_pop(dit, "x")  # index 'x' not found
})
```

---

rename *Rename Elements Safely*

Description

Search for old name and replace it by new name. If either the old name does not exist or the name would result in a name-clash with an already existing name, an error is signaled.

Usage

```
rename(.x, old, new)

ref_rename(.x, old, new)

## S3 method for class 'Container'
rename(.x, old, new)
```

```
## S3 method for class 'dict.table'
rename(.x, old, new)

## S3 method for class 'dict.table'
ref_rename(.x, old, new)

## Default S3 method:
rename(.x, old, new)
```

Arguments

.x	dict.table object
old	character old name
new	character new name

Details

The passed old and new names can be vectors but always must have the same length and must be unique to prevent double-renaming.

rename uses copy semantics while ref_rename works by reference, that is, it renames elements in place.

Value

For standard R vectors renames old to new and returns the renamed vector.

For Container, an object of class Container (or one of the respective derived classes).

For dict.table renames key old to new in place (i.e. by reference) and invisibly returns the dict.table() object.

Examples

```
# Container
co = container(a = 1, b = 2, 3)
rename(co, c("a", "b"), c("a1", "y"))
print(co)
ref_rename(co, c("a", "b"), c("a1", "y"))
print(co)

# dict.table
dit = dict.table(a = 1, b = 2, c = 3)
rename(dit, c("a", "b"), c("a1", "y"))
print(dit)
ref_rename(dit, c("a", "b"), c("a1", "y"))
print(dit)
```

replace *Replace Values in Containers Safely*

Description

Try to find and replace elements and signal an error if not found, unless it is stated to explicitly add the element (see option add).

Usage

```
replace(.x, ...)

ref_replace(.x, ...)

## S3 method for class 'Container'
replace(.x, old, new, add = FALSE, ...)

## S3 method for class 'Container'
ref_replace(.x, old, new, add = FALSE, ...)

## S3 method for class 'Dict'
replace(.x, old, new, ...)

## S3 method for class 'Dict'
ref_replace(.x, old, new, ...)
```

Arguments

.x	any R object.
...	additional arguments to be passed to or from methods.
old	old element to be found and replaced.
new	the new element replacing the old one.
add	logical if FALSE (default) and element was not found, an error is given. In contrast, if set to TRUE the new element is added regardless of whether it is used as a replacement for an existing element or just added as a new element.

Details

replace uses copy semantics while ref_replace works by reference.

Value

For Container, an object of class Container (or one of the respective derived classes).

For Dict an object of class Dict.

Examples

```
co = container("x", 9)
replace(co, 9, 0)
replace(co, "x", 0)
try({
replace(co, "z", 0)              # old element ("z") is not in Container
})
replace(co, "z", 0, add = TRUE)  # just add the zero without replacement


d = dict(a = 1, b = "z")
replace(d, 1, 1:5)
replace(d, "z", "a")

try({
replace(d, "a", 2)              # old element ("a") is not in Dict
})
```

---

replace_at *Replace Values at Indices Safely*

Description

Try to find and replace elements at given indices and signal an error if not found, unless it is stated to explicitly add the element (see option add).

Usage

```
replace_at(.x, ...)

ref_replace_at(.x, ...)

## S3 method for class 'Container'
replace_at(.x, ..., .add = FALSE)

## S3 method for class 'Container'
ref_replace_at(.x, ..., .add = FALSE)

## S3 method for class 'dict.table'
replace_at(.x, ..., .add = FALSE)

## S3 method for class 'dict.table'
ref_replace_at(.x, ..., .add = FALSE)
```

Arguments

.x	any R object.
...	either name = value pairs or two vectors/lists with names/values to be replaced.

.add — logical if FALSE (default) and index is invalid, an error is given. If set to TRUE the new element is added at the given index regardless whether the index existed or not. Indices can consist of numbers or names or both, except when adding values at new indices, which is only allowed for names.

Details

replace_at uses copy semantics while ref_replace_at works by reference.

Value

For Container, an object of class Container (or one of the respective derived classes).

For dict.table an object of class dict.table.

Examples

```
co = container(a = 0, b = "z")
replace_at(co, a = 1, b = 2)
replace_at(co, 1:2, 1:2)                # same
replace_at(co, c("a", "b"), list(1, 2))  # same

try({
replace_at(co, x = 1)                   # names(s) not found: 'x'
})
replace_at(co, x = 1, .add = TRUE)      # ok (adds x = 1)


dit = dict.table(a = 1:3, b = 4:6)
replace_at(dit, a = 3:1)
replace_at(dit, 1, 3:1)                 # same
replace_at(dit, "a", 3:1)               # same
replace_at(dit, a = 3:1, b = 6:4)
replace_at(dit, 1:2, list(3:1, 6:4))    # same

try({
replace_at(dit, x = 1)                  # column(s) not found: 'x'
})
replace_at(dit, x = 1, .add = TRUE)     # ok (adds column)
```

---

rev *Reverse Elements*

Description

rev provides a reversed version of its argument.

Usage

```
ref_rev(x)

## S3 method for class 'Deque'
ref_rev(x)

## S3 method for class 'Deque'
rev(x)
```

Arguments

x	Deque object

Details

`rev` uses copy semantics while `ref_rev` works by reference, that is, it reverse all elements in place.

Value

For `Deque`, an object of class `Deque`

See Also

`base::rev()`

Examples

```
d = deque(a = 1, b = 2, 3)
rev(d)
print(d)
ref_rev(d)
print(d)
```

`rotate` *Rotate Elements*

Description

Rotate all elements `n` steps to the right. If `n` is negative, rotate to the left.

Usage

```
rotate(x, n = 1L)

ref_rotate(x, n = 1L)

## S3 method for class 'Deque'
```

```
rotate(x, n = 1L)

## S3 method for class 'Deque'
ref_rotate(x, n = 1L)
```

Arguments

x	any R object.
n	integer number of steps to rotate

Details

While rotate uses copy semantics, ref_rotate works by reference, that is, rotates in place on the original object.

Value

For Deque returns the rotated Deque() object.

Examples

```
d = deque(1, 2, 3, 4)
rotate(d)
rotate(d, n = 2)
```

Set *Set Class*

Description

The Set is considered and implemented as a specialized Container, that is, elements are always unique in the Container and it provides typical set operations such as union and intersect. For the standard S3 interface, see setnew().

Super classes

container::Iterable -> container::Container -> Set

Methods

Public methods:

- Set$new()
- Set$add()
- Set$diff()
- Set$intersect()
- Set$union()
- Set$is_equal()

- Set$is_subset()
- Set$is_proper_subset()
- Set$values()
- Set$clone()

Method `new()`**:** `Set` constructor

Usage:

```
Set$new(...)
```

Arguments:

`...` initial elements put into the `Set`

Returns: returns the `Set` object

Method `add()`**:** Add element

Usage:

```
Set$add(value, name = NULL)
```

Arguments:

`value` value of `ANY` type to be added to the `Set`.

`name` `character` optional name attribute of the value.

Returns: the `Set` object.

Method `diff()`**:** `Set` difference

Usage:

```
Set$diff(s)
```

Arguments:

`s` `Set` object to 'subtract'

Returns: the `Set` object updated as a result of the set difference between this and s.

Method `intersect()`**:** `Set` intersection

Usage:

```
Set$intersect(s)
```

Arguments:

`s` `Set` object to 'intersect'

Returns: the `Set` object as a result of the intersection of this and s.

Method `union()`**:** `Set` union

Usage:

```
Set$union(s)
```

Arguments:

`s` `Set` object to be 'unified'

Returns: the `Set` object as a result of the union of this and s.

Method `is_equal()`**:** `Set` equality

Usage:

```
Set$is_equal(s)
```

Arguments:

`s` `Set` object to compare against

Returns: `TRUE` if this is equal to `s`, otherwise `FALSE`

Method `is_subset()`**:** `Set` proper subset

Usage:

```
Set$is_subset(s)
```

Arguments:

`s` `Set` object to compare against

Returns: `TRUE` if this is subset of `s`, otherwise `FALSE`

Method `is_proper_subset()`**:** `Set` subset

Usage:

```
Set$is_proper_subset(s)
```

Arguments:

`s` `Set` object to compare against

Returns: `TRUE` if this is proper subset of `s`, otherwise `FALSE`

Method `values()`**:** Get `Set` values

Usage:

```
Set$values()
```

Returns: elements of the set as a base list

Method `clone()`**:** The objects of this class are cloneable with this method.

Usage:

```
Set$clone(deep = FALSE)
```

Arguments:

`deep` Whether to make a deep clone.

See Also

Container, `setnew()`

Examples

```
s1 = Set$new(1, 2)
s1
s1$add(1)
s1$add(3)
s2 = Set$new(3, 4, 5)
s1$union(s2)
s1
```

```
s1 = Set$new(1, 2, 3)
s1$intersect(s2)
s1

s1$diff(s2)
s1$diff(s1)
s1
```

SetS3 *Set and ordered Set*

Description

The Set is considered and implemented as a specialized Container, that is, Set elements are always unique. It provides typical set operations such as union and intersect.

Usage

```
setnew(..., .ordered = FALSE)

as.set(x)

as.orderedset(x)

is.set(x)

is.orderedset(x)
```

Arguments

...	initial elements put into the Set.
.ordered	logical if TRUE all elements in the Set will be ordered.
x	R object of ANY type for as.set() and is.set() or of class Set for the S3 methods.

Details

Methods that alter Set objects usually come in two versions providing either copy or reference semantics where the latter start with 'ref_' to note the reference semantic, for example, add() and ref_add().

- setnew(...) initializes and returns a Set() object.
- as.set(x) coerces x to a set.
- as.orderedset(x) coerces x to an ordered set.
- is.set(x) returns TRUE if x is of class Set and FALSE otherwise.

- `is.orderedset(x)` returns `TRUE` if `x` is of class `OrderedSet` and `FALSE` otherwise.
- `x & y` performs the set intersection of x and y
- `x | y` performs the set union of x and y

See Also

See `container()` for all inherited methods. For the full class documentation see Set and it's superclass Container.

Examples

```
s = setnew(1, b = NA, 1:3, c = container("a", 1))
is.set(s)
print(s)
length(s)
names(s)
as.list(s)
unpack(s)   # flatten recursively similar to unlist

so = setnew(2, 1, .ordered = TRUE)
print(so)
add(so, 0)
# Math
s = setnew(5:3, 1, 2)
s
abs(s)
cumsum(s)
round(s)
exp(s)

# Summary
range(s)
min(s)
max(s)

s1 = setnew(1, 1:2)
s2 = setnew(2, 1:2)
s1 + s2     # same as s1 | s2 or c(c1, s2)
s2 + s1     # same

s1 - s2
s2 - s1

s1 = setnew(1, b = 2)
s2 = setnew(1, b = 4)
s1 & s2     # {1}

s1 | s2     # {1, b = 2, b = 4}
```

unpack *Unpack Nested Objects*

Description

Similary to `unlist()` recursively unpacks any (possibly nested) structure into a flat list. In contrast to `unlist()`, `unpack()` also works with (possibly nested) `Container()` objects. In principle, it works for any object that can be transformed to a list via `as.list`.

Usage

```
unpack(x, recursive = TRUE, use.names = TRUE)
```

Arguments

`x`	any R object
`recursive`	`logical` descend recursively into nested objects?
`use.names`	`logical` Should names be preserved?

Value

a `list`

update *Update Object with Elements from Another Object*

Description

Takes an object and updates it with values from another object by replacing the values at existing names and adding values at new names of the other object. A common use case is to update parameter lists.

Usage

```
ref_update(object, other, ...)

## S3 method for class 'Container'
update(object, other, ...)

## S3 method for class 'Container'
ref_update(object, other, ...)

## S3 method for class 'dict.table'
update(object, other, ...)
```

```
## S3 method for class 'dict.table'
ref_update(object, other, ...)

## S3 method for class 'list'
update(object, other, ...)
```

Arguments

object	any R object
other	any object of the same type as object
...	additional arguments to be passed to or from methods.

Details

update uses copy semantics while ref_update works by reference, that is, updates in place.

Value

For Container, an object of class Container (or one of the respective derived classes).

For dict.table an object of class dict.table.

For list, an updated object of class list.

Examples

```
d1 = dict(a = 1, b = 2)
d2 = dict(       b = 0, c = 3)
update(d1, d2)  # {a = 1, b = 0, c = 3}
update(d2, d1)  # {a = 1, b = 2, c = 3}

dit1 = dict.table(a = 1:2, b = 3:4)
dit2 = dict.table(         b = 5:6, c = 8:9)
update(d1, d2)
update(d2, d1)

l1 = list(1, b = 2)
l2 = list(   b = 0, c = 3)
update(l1, l2)
update(l2, l1)
```

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