

# Contents

1	Module <code>Strat</code> : Interface to strategies	1
2	Module <code>Pres_intf</code> : Interface to parameterized resizable arrays	1
3	Module <code>Nopres_intf</code> : Interfaces to unparameterized resizable arrays and buffers	8
4	Module <code>Weak_intf</code> : Interface to weak resizable arrays	16
5	Module <code>Res</code> : Global module for resizable datastructures and default implementations	23

## 1 Module `Strat` : Interface to strategies

```
module type T =
  sig
    type t
      The abstract type of strategies.

    val default : t
      Default strategy of this strategy implementation.

    val grow : t -> int -> int
      grow strat new_len
      Returns the new real length of some contiguous datastructure using strategy strat
      given new virtual length new_len. The user should then use this new real length to
      resize the datastructure.
      Be careful, the new (real) length must be larger than the new virtual length, otherwise
      your program will crash!

    val shrink : t -> real_len:int -> new_len:int -> int
      shrink strat ~real_len ~new_len
      Returns the new real length of a resizable datastructure given its current real length
      real_len and its required new virtual length new_len wrt. strategy strat. The user
      should then use this new real length to resize the datastructure. If -1 is returned, it is
      not necessary to resize.
      Be careful, the new (real) length must be larger than the new (virtual) length,
      otherwise your program may crash!

  end
```

## 2 Module Pres\_intf : Interface to parameterized resizable arrays

```
module type T =
  sig
    Signatures and types
    module Strategy :
      Strat.T
      Module implementing the reallocation strategy

    type strategy = Strategy.t
      Type of reallocation strategy

    type 'a t
      Type of parameterized resizable arrays

    Index and length information
    val length : 'a t -> int
      length ra
      Returns (virtual) length of resizable array ra excluding the reserved space.

    val lix : 'a t -> int
      lix ra
      Returns (virtual) last index of resizable array ra excluding the reserved space.

    val real_length : 'a t -> int
      real_length ra
      Returns (real) length of resizable array ra including the reserved space.

    val real_lix : 'a t -> int
      real_lix ra
      Returns (real) last index of resizable array ra including the reserved space.

    Getting and setting
    val get : 'a t -> int -> 'a
      get ra n
      Raises Invalid_argument if index out of bounds.
      Returns the nth element of ra.

    val set : 'a t -> int -> 'a -> unit
```

`set ra n` sets the `n`th element of `ra`.  
**Raises** `Invalid_argument` if index out of bounds.

Creation of resizable arrays

`val empty : strategy -> 'a t`

`empty s`

**Returns** an empty resizable array using strategy `s`.

`val empty : unit -> 'a t`

`empty ()` same as `empty` but uses default strategy.

`val screate : strategy -> int -> 'a -> 'a t`

`screate s n el`

**Returns** a resizable array of length `n` containing element `el` only using strategy `s`.

`val create : int -> 'a -> 'a t`

`create n el` same as `screate` but uses default strategy.

`val smake : strategy -> int -> 'a -> 'a t`

`smake s n el` same as `screate`.

`val make : int -> 'a -> 'a t`

`make n el` same as `create`.

`val sinit : strategy -> int -> (int -> 'a) -> 'a t`

`sinit s n f`

**Returns** an array of length `n` containing elements that were created by applying function `f` to the index, using strategy `s`.

`val init : int -> (int -> 'a) -> 'a t`

`init n f` same as `sinit` but uses default strategy.

Strategy handling

`val get_strategy : 'a t -> strategy`

`get_strategy ra`

**Returns** the reallocation strategy used by resizable array `ra`.

`val set_strategy : 'a t -> strategy -> unit`

`set_strategy ra s` sets the reallocation strategy of resizable array `ra` to `s`, possibly causing an immediate reallocation.

```
val put_strategy : 'a t -> strategy -> unit
```

`put_strategy ra s` sets the reallocation strategy of resizable array `ra` to `s`.  
Reallocation is only done at later changes in size.

```
val enforce_strategy : 'a t -> unit
```

`enforce_strategy ra` forces a reallocation if necessary (e.g. after a `put_strategy`).

Matrix functions

```
val make_matrix : int -> int -> 'a -> 'a t t
```

`make_matrix sx sy el` creates a (resizable) matrix of dimensions `sx` and `sy` containing element `el` only. Both dimensions are controlled by the default strategy.

Copying, blitting and range extraction

```
val copy : 'a t -> 'a t
```

`copy ra`

**Returns** a copy of resizable array `ra`. The two arrays share the same strategy!

```
val sub : 'a t -> int -> int -> 'a t
```

`sub ra ofs len`

**Raises** `Invalid_argument` if parameters do not denote a correct subarray.

**Returns** a resizable subarray of length `len` from resizable array `ra` starting at offset `ofs` using the default strategy.

```
val fill : 'a t -> int -> int -> 'a -> unit
```

`fill ra ofs len el` fills resizable array `ra` from offset `ofs` with `len` elements `el`, possibly adding elements at the end. Raises `Invalid_argument` if offset `ofs` is larger than the length of the array.

```
val blit : 'a t -> int -> 'a t -> int -> int -> unit
```

`blit ra1 ofs1 ra2 ofs2 len` blits resizable array `ra1` onto `ra2` reading `len` elements from offset `ofs1` and writing them to `ofs2`, possibly adding elements at the end of `ra2`. Raises `Invalid_argument` if `ofs1` and `len` do not designate a valid subarray of `ra1` or if `ofs2` is larger than the length of `ra2`.

Combining resizable arrays

```
val append : 'a t -> 'a t -> 'a t
```

`append ra1 ra2`

**Returns** a new resizable array using the default strategy and copying `ra1` and `ra2` in this order onto it.

```
val concat : 'a t list -> 'a t
```

`concat l`

**Returns** a new resizable array using the default strategy and copying all resizable arrays in `l` in their respective order onto it.

Adding and removing elements

`val add_one : 'a t -> 'a -> unit`

`add_one ra el` adds element `el` to resizable array `ra`, possibly causing a reallocation.

`val remove_one : 'a t -> unit`

`remove_one ra` removes the last element of resizable array `ra`, possibly causing a reallocation.

**Raises** `Failure` if the array is empty.

`val remove_n : 'a t -> int -> unit`

`remove_n ra n` removes the last `n` elements of resizable array `ra`, possibly causing a reallocation.

**Raises** `Invalid_arg` if there are not enough elements or `n < 0`.

`val remove_range : 'a t -> int -> int -> unit`

`remove_range ra ofs len` removes `len` elements from resizable array `ra` starting at `ofs` and possibly causing a reallocation.

**Raises** `Invalid_argument` if range is invalid.

`val clear : 'a t -> unit`

`clear ra` removes all elements from resizable array `ra`, possibly causing a reallocation.

Swapping

`val swap : 'a t -> int -> int -> unit`

`swap ra n m` swaps elements at indices `n` and `m`.

**Raises** `Invalid_argument` if any index is out of range.

`val swap_in_last : 'a t -> int -> unit`

`swap_in_last ra n` swaps the last element with the one at position `n`.

**Raises** `Invalid_argument` if index `n` is out of range.

Array conversions

`val to_array : 'a t -> 'a array`

`to_array ra` converts a resizable array to a standard one.

`val sof_array : strategy -> 'a array -> 'a t`

`sof_array s ar` converts a standard array to a resizable one, using strategy `s`.

`val of_array : 'a array -> 'a t`

`of_array ar` converts a standard array to a resizable one using the default strategy.

List conversions

`val to_list : 'a t -> 'a list`

`to_list ra` converts resizable array `ra` to a list.

`val sof_list : strategy -> 'a list -> 'a t`

`sof_list s l` creates a resizable array using strategy `s` and the elements in list `l`.

`val of_list : 'a list -> 'a t`

`of_list l` creates a resizable array using the default strategy and the elements in list `l`.

Iterators

`val iter : ('a -> unit) -> 'a t -> unit`

`iter f ra` applies the unit-function `f` to each element in resizable array `ra`.

`val map : ('a -> 'b) -> 'a t -> 'b t`

`map f ra`

**Returns** a resizable array using the strategy of `ra` and mapping each element in `ra` to its corresponding position in the new array using function `f`.

`val iteri : (int -> 'a -> unit) -> 'a t -> unit`

`iteri f ra` applies the unit-function `f` to each index and element in resizable array `ra`.

`val mapi : (int -> 'a -> 'b) -> 'a t -> 'b t`

`mapi f ra`

**Returns** a resizable array using the strategy of `ra` and mapping each element in `ra` to its corresponding position in the new array using function `f` and the index position.

`val fold_left : ('b -> 'a -> 'b) -> 'b -> 'a t -> 'b`

`fold_left f a ra` left-folds values in resizable array `ra` using function `f` and start accumulator `a`.

`val fold_right : ('a -> 'b -> 'b) -> 'a t -> 'b -> 'b`

`fold_right f a ra` right-folds values in resizable array `ra` using function `f` and start accumulator `a`.

Scanning of resizable arrays

```
val for_all : ('a -> bool) -> 'a t -> bool
```

```
    for_all p ra
```

**Returns** true if all elements in resizable array `ra` satisfy the predicate `p`, false otherwise.

```
val exists : ('a -> bool) -> 'a t -> bool
```

```
    exists p ra
```

**Returns** true if at least one element in resizable array `ra` satisfies the predicate `p`, false otherwise.

```
val mem : 'a -> 'a t -> bool
```

```
    mem el ra
```

**Returns** true if element `el` is logically equal to any element in resizable array `ra`, false otherwise.

```
val memq : 'a -> 'a t -> bool
```

```
    memq el ra
```

**Returns** true if element `el` is physically equal to any element in resizable array `ra`, false otherwise.

```
val pos : 'a -> 'a t -> int option
```

```
    pos el ra
```

**Returns** Some `index` if `el` is logically equal to the element at `index` in `ra`, None otherwise. `index` is the index of the first element that matches.

```
val posq : 'a -> 'a t -> int option
```

```
    posq el ra
```

**Returns** Some `index` if `el` is physically equal to the element at `index` in `ra`, None otherwise. `index` is the index of the first element that matches.

Searching of resizable arrays

```
val find : ('a -> bool) -> 'a t -> 'a
```

```
    find p ra
```

**Raises** Not\_found if there is no such element.

**Returns** the first element in resizable array `ra` that satisfies predicate `p`.

```
val find_index : ('a -> bool) -> 'a t -> int -> int
```

```
    find_index p ra pos
```

**Raises**

- **Not\_found** if there is no such element or if **pos** is larger than the highest index.
- **Invalid\_argument** if **pos** is negative.

**Returns** the index of the first element that satisfies predicate **p** in resizable array **ra**, starting search at index **pos**.

```
val filter : ('a -> bool) -> 'a t -> 'a t
```

```
  filter p ra
```

**Returns** a new resizable array by filtering out all elements in **ra** that satisfy predicate **p** using the same strategy as **ra**.

```
val find_all : ('a -> bool) -> 'a t -> 'a t
```

```
  find_all p ra is the same as filter
```

```
val filter_in_place : ('a -> bool) -> 'a t -> unit
```

```
  filter_in_place p ra as filter, but filters in place.
```

```
val partition : ('a -> bool) -> 'a t -> 'a t * 'a t
```

```
  partition p ra
```

**Returns** a pair of resizable arrays, the left part containing only elements of **ra** that satisfy predicate **p**, the right one only those that do not satisfy it. Both returned arrays are created using the strategy of **ra**.

#### **UNSAFE STUFF - USE WITH CAUTION!**

```
val unsafe_get : 'a t -> int -> 'a
```

```
val unsafe_set : 'a t -> int -> 'a -> unit
```

```
val unsafe_sub : 'a t -> int -> int -> 'a t
```

```
val unsafe_fill : 'a t -> int -> int -> 'a -> unit
```

```
val unsafe_blit : 'a t -> int -> 'a t -> int -> int -> unit
```

```
val unsafe_remove_one : 'a t -> unit
```

```
val unsafe_remove_n : 'a t -> int -> unit
```

```
val unsafe_swap : 'a t -> int -> int -> unit
```

```
val unsafe_swap_in_last : 'a t -> int -> unit
```

```
end
```

### **3 Module Nopres\_intf : Interfaces to unparameterized resizable arrays and buffers**

```
module type T =
```

```
  sig
```



Signatures and types

```
module Strategy :
```

```
Strat.T
```

Module implementing the reallocation strategy

```
type strategy = Strategy.t
```

Type of reallocation strategy

```
type t
```

Type of resizable arrays

```
type el
```

Type of the elements in the resizable array

Index and length information

```
val length : t -> int
```

length *ra*

**Returns** (virtual) length of resizable array *ra* excluding the reserved space.

```
val lix : t -> int
```

lix *ra*

**Returns** (virtual) last index of resizable array *ra* excluding the reserved space.

```
val real_length : t -> int
```

real\_length *ra*

**Returns** (real) length of resizable array *ra* including the reserved space.

```
val real_lix : t -> int
```

real\_lix *ra*

**Returns** (real) last index of resizable array *ra* including the reserved space.

Getting and setting

```
val get : t -> int -> el
```

get *ra* *n*

**Raises** *Invalid\_argument* if index out of bounds.

**Returns** the *n*th element of *ra*.

```
val set : t -> int -> el -> unit
```

set *ra* *n* sets the *n*th element of *ra*.

**Raises** *Invalid\_argument* if index out of bounds.

Creation of resizable arrays

```
val empty : strategy -> t
```

```
    empty s
```

**Returns** an empty resizable array using strategy **s**.

```
val empty : unit -> t
```

**empty** () same as **empty** but uses default strategy.

```
val screate : strategy -> int -> t
```

```
    screate s n
```

**Returns** a resizable array with strategy **s** containing **n** arbitrary elements.

*Attention: the contents is **not** specified!*

```
val create : int -> t
```

**create** n same as **screate** but uses default strategy.

```
val smake : strategy -> int -> el -> t
```

```
    smake s n el
```

**Returns** a resizable array of length **n** containing element **el** only using strategy **s**.

```
val make : int -> el -> t
```

**make** n **el** same as **smake** but uses default strategy.

```
val sinit : strategy -> int -> (int -> el) -> t
```

```
    sinit s n f
```

**Returns** an array of length **n** containing elements that were created by applying function **f** to the index, using strategy **s**.

```
val init : int -> (int -> el) -> t
```

**init** n **f** same as **sinit** but uses default strategy.

Strategy handling

```
val get_strategy : t -> strategy
```

```
    get_strategy ra
```

**Returns** the reallocation strategy used by resizable array **ra**.

```
val set_strategy : t -> strategy -> unit
```

**set\_strategy** **ra** **s** sets the reallocation strategy of resizable array **ra** to **s**, possibly causing an immediate reallocation.

```
val put_strategy : t -> strategy -> unit
```

`put_strategy ra s` sets the reallocation strategy of resizable array `ra` to `s`.  
Reallocation is only done at later changes in size.

```
val enforce_strategy : t -> unit
```

`enforce_strategy ra` forces a reallocation if necessary (e.g. after a `put_strategy`).

Copying, blitting and range extraction

```
val copy : t -> t
```

`copy ra`

**Returns** a copy of resizable array `ra`. The two arrays share the same strategy!

```
val sub : t -> int -> int -> t
```

`sub ra ofs len`

**Raises** `Invalid_argument` if parameters do not denote a correct subarray.

**Returns** a resizable subarray of length `len` from resizable array `ra` starting at offset `ofs` using the default strategy.

```
val fill : t -> int -> int -> el -> unit
```

`fill ra ofs len el` fills resizable array `ra` from offset `ofs` with `len` elements `el`, possibly adding elements at the end. **Raises** `Invalid_argument` if offset `ofs` is larger than the length of the array.

```
val blit : t -> int -> t -> int -> int -> unit
```

`blit ra1 ofs1 ra2 ofs2 len` blits resizable array `ra1` onto `ra2` reading `len` elements from offset `ofs1` and writing them to `ofs2`, possibly adding elements at the end of `ra2`. **Raises** `Invalid_argument` if `ofs1` and `len` do not designate a valid subarray of `ra1` or if `ofs2` is larger than the length of `ra2`.

Combining resizable arrays

```
val append : t -> t -> t
```

`append ra1 ra2`

**Returns** a new resizable array using the default strategy and copying `ra1` and `ra2` in this order onto it.

```
val concat : t list -> t
```

`concat l`

**Returns** a new resizable array using the default strategy and copying all resizable arrays in `l` in their respective order onto it.

Adding and removing elements

```
val add_one : t -> el -> unit
```

`add_one ra el` adds element `el` to resizable array `ra`, possibly causing a reallocation.

`val remove_one : t -> unit`

`remove_one ra` removes the last element of resizable array `ra`, possibly causing a reallocation.

**Raises Failure** if the array is empty.

`val remove_n : t -> int -> unit`

`remove_n ra n` removes the last `n` elements of resizable array `ra`, possibly causing a reallocation.

**Raises Invalid\_arg** if there are not enough elements or `n < 0`.

`val remove_range : t -> int -> int -> unit`

`remove_range ra ofs len` removes `len` elements from resizable array `ra` starting at `ofs` and possibly causing a reallocation.

**Raises Invalid\_argument** if range is invalid.

`val clear : t -> unit`

`clear ra` removes all elements from resizable array `ra`, possibly causing a reallocation.

#### Swapping

`val swap : t -> int -> int -> unit`

`swap ra n m` swaps elements at indices `n` and `m`.

**Raises Invalid\_argument** if any index is out of range.

`val swap_in_last : t -> int -> unit`

`swap_in_last ra n` swaps the last element with the one at position `n`.

**Raises Invalid\_argument** if index `n` is out of range.

#### Array conversions

`val to_array : t -> el array`

`to_array ra` converts a resizable array to a standard one.

`val sof_array : strategy -> el array -> t`

`sof_array s ar` converts a standard array to a resizable one, using strategy `s`.

`val of_array : el array -> t`

`of_array ar` converts a standard array to a resizable one using the default strategy.

#### List conversions

`val to_list : t -> el list`

`to_list ra` converts resizable array `ra` to a list.

`val sof_list : strategy -> el list -> t`

`sof_list s l` creates a resizable array using strategy `s` and the elements in list `l`.

`val of_list : el list -> t`

`of_list l` creates a resizable array using the default strategy and the elements in list `l`.

Iterators

`val iter : (el -> unit) -> t -> unit`

`iter f ra` applies the unit-function `f` to each element in resizable array `ra`.

`val map : (el -> el) -> t -> t`

`map f ra`

**Returns** a resizable array using the strategy of `ra` and mapping each element in `ra` to its corresponding position in the new array using function `f`.

`val iteri : (int -> el -> unit) -> t -> unit`

`iteri f ra` applies the unit-function `f` to each index and element in resizable array `ra`.

`val mapi : (int -> el -> el) ->  
t -> t`

`mapi f ra`

**Returns** a resizable array using the strategy of `ra` and mapping each element in `ra` to its corresponding position in the new array using function `f` and the index position.

`val fold_left : ('a -> el -> 'a) -> 'a -> t -> 'a`

`fold_left f a ra` left-folds values in resizable array `ra` using function `f` and start accumulator `a`.

`val fold_right : (el -> 'a -> 'a) -> t -> 'a -> 'a`

`fold_right f a ra` right-folds values in resizable array `ra` using function `f` and start accumulator `a`.

Scanning of resizable arrays

`val for_all : (el -> bool) -> t -> bool`

`for_all p ra`

**Returns** `true` if all elements in resizable array `ra` satisfy the predicate `p`, `false` otherwise.

`val exists : (el -> bool) -> t -> bool`

```

exists p ra
Returns true if at least one element in resizable array ra satisfies the predicate p,
false otherwise.

val mem : el -> t -> bool

mem el ra
Returns true if element el is logically equal to any element in resizable array ra,
false otherwise.

val memq : el -> t -> bool

memq el ra
Returns true if element el is physically equal to any element in resizable array ra,
false otherwise.

val pos : el -> t -> int option

pos el ra
Returns Some index if el is logically equal to the element at index in ra, None
otherwise. index is the index of the first element that matches.

val posq : el -> t -> int option

posq el ra
Returns Some index if el is physically equal to the element at index in ra, None
otherwise. index is the index of the first element that matches.

Searching of resizable arrays

val find : (el -> bool) -> t -> el

find p ra
Raises Not_found if there is no such element.
Returns the first element in resizable array ra that satisfies predicate p.

val find_index : (el -> bool) -> t -> int -> int

find_index p ra pos
Raises

- Not_found if there is no such element or if pos is larger than the highest index.
- Invalid_argument if pos is negative.

Returns the index of the first element that satisfies predicate p in resizable array ra,
starting search at index pos.

val filter : (el -> bool) -> t -> t

filter p ra
Returns a new resizable array by filtering out all elements in ra that satisfy predicate
p using the same strategy as ra.

```

```

val find_all : (el -> bool) -> t -> t
    find_all p ra is the same as filter

val filter_in_place : (el -> bool) -> t -> unit
    filter_in_place p ra as filter, but filters in place.

val partition : (el -> bool) ->
    t -> t * t

    partition p ra
Returns a pair of resizable arrays, the left part containing only elements of ra that
satisfy predicate p, the right one only those that do not satisfy it. Both returned arrays
are created using the strategy of ra.

```

### UNSAFE STUFF - USE WITH CAUTION!

```

val unsafe_get : t -> int -> el
val unsafe_set : t -> int -> el -> unit
val unsafe_sub : t -> int -> int -> t
val unsafe_fill : t -> int -> int -> el -> unit
val unsafe_blit : t -> int -> t -> int -> int -> unit
val unsafe_remove_one : t -> unit
val unsafe_remove_n : t -> int -> unit
val unsafe_swap : t -> int -> int -> unit
val unsafe_swap_in_last : t -> int -> unit
end

```

Interface to unparameterized resizable arrays

```

module type Buffer =

```

```

    sig

```

```

        include Nopres_intf.T

```

Includes all functions that exist in non-parameterized arrays.

String conversions

```

val sof_string : strategy -> string -> t

```

**sof\_string** **s** **ar** converts a string to a resizable buffer using strategy **s**.

```

val of_string : string -> t

```

**of\_string** **ar** converts a string to a resizable buffer using the default strategy.

Functions found in the standard Buffer-module

Note that the function **create n** ignores the parameter **n** and uses the default strategy instead. You can supply a different strategy with **creates s n** as described above.

```

val contents : t -> string

```

```

    contents b
Returns a copy of the current contents of the buffer b.

val reset : t -> unit
    reset b just clears the buffer, possibly resizing it.

val add_char : t -> char -> unit
    add_char b c appends the character c at the end of the buffer b.

val add_string : t -> string -> unit
    add_string b s appends the string s at the end of the buffer b.

val add_substring : t -> string -> int -> int -> unit
    add_substring b s ofs len takes len characters from offset ofs in string s and
    appends them at the end of the buffer b.

val add_buffer : t -> t -> unit
    add_buffer b1 b2 appends the current contents of buffer b2 at the end of buffer b1.
    b2 is not modified.

val add_channel : t -> Pervasives.in_channel -> int -> unit
    add_channel b ic n reads exactly n character from the input channel ic and stores
    them at the end of buffer b.
    Raises End_of_file if the channel contains fewer than n characters.

val output_buffer : Pervasives.out_channel -> t -> unit
    output_buffer oc b writes the current contents of buffer b on the output channel oc.

Additional buffer functions
val add_full_channel : t -> Pervasives.in_channel -> unit
val add_full_channel_f :
    t -> Pervasives.in_channel -> int -> (int -> int) -> unit
end

Extended interface to buffers (resizable strings)

```



## 4 Module Weak\_intf : Interface to weak resizable arrays

```
module type T =
  sig
    Signatures and types
    module Strategy :
      Strat.T
      Module implementing the reallocation strategy

    type strategy = Strategy.t
      Type of reallocation strategy

    type 'a t
      Type of parameterized resizable arrays

    Index and length information
    val length : 'a t -> int
      length ra
      Returns (virtual) length of resizable array ra excluding the reserved space.

    val lix : 'a t -> int
      lix ra
      Returns (virtual) last index of resizable array ra excluding the reserved space.

    val real_length : 'a t -> int
      real_length ra
      Returns (real) length of resizable array ra including the reserved space.

    val real_lix : 'a t -> int
      real_lix ra
      Returns (real) last index of resizable array ra including the reserved space.

    Getting, setting and checking
    val get : 'a t -> int -> 'a option
      get ra n
      Raises Invalid_argument if index out of bounds.
      Returns the nth element of ra.

    val get_copy : 'a t -> int -> 'a option
```

`get_copy ra n` see documentation of module `Weak` in the standard distribution.

`val check : 'a t -> int -> bool`

`check ra n`

**Returns** true if the `n`th cell of `ra` is full, false if it is empty. Note that even if `check ar n` returns true, a subsequent `Weak_intf.T.get[4] ar n` can return `None`.

`val set : 'a t -> int -> 'a option -> unit`

`set ra n` sets the `n`th element of `ra`.

**Raises** `Invalid_argument` if index out of bounds.

Creation of resizable arrays

`val sempty : strategy -> 'a t`

`sempty s`

**Returns** an empty resizable array using strategy `s`.

`val empty : unit -> 'a t`

`empty ()` same as `sempty` but uses default strategy.

`val screate : strategy -> int -> 'a t`

`screate s n el`

**Returns** a resizable array of length `n` using strategy `s`.

`val create : int -> 'a t`

`create n` same as `screate` but uses default strategy.

`val sinit : strategy -> int -> (int -> 'a option) -> 'a t`

`sinit s n f`

**Returns** an array of length `n` containing elements that were created by applying function `f` to the index, using strategy `s`.

`val init : int -> (int -> 'a option) -> 'a t`

`init n f` same as `sinit` but uses default strategy.

Strategy handling

`val get_strategy : 'a t -> strategy`

`get_strategy ra`

**Returns** the reallocation strategy used by resizable array `ra`.

`val set_strategy : 'a t -> strategy -> unit`

`set_strategy ra s` sets the reallocation strategy of resizable array `ra` to `s`, possibly causing an immediate reallocation.

`val put_strategy : 'a t -> strategy -> unit`

`put_strategy ra s` sets the reallocation strategy of resizable array `ra` to `s`.  
Reallocation is only done at later changes in size.

`val enforce_strategy : 'a t -> unit`

`enforce_strategy ra` forces a reallocation if necessary (e.g. after a `put_strategy`.

Copying, blitting and range extraction

`val copy : 'a t -> 'a t`

`copy ra`

**Returns** a copy of resizable array `ra`. The two arrays share the same strategy!

`val sub : 'a t -> int -> int -> 'a t`

`sub ra ofs len`

**Raises** `Invalid_argument` if parameters do not denote a correct subarray.

**Returns** a resizable subarray of length `len` from resizable array `ra` starting at offset `ofs` using the default strategy.

`val fill : 'a t -> int -> int -> 'a option -> unit`

`fill ra ofs len el` fills resizable array `ra` from offset `ofs` with `len` elements `el`, possibly adding elements at the end. **Raises** `Invalid_argument` if offset `ofs` is larger than the length of the array.

`val blit : 'a t -> int -> 'a t -> int -> int -> unit`

`blit ra1 ofs1 ra2 ofs2 len` blits resizable array `ra1` onto `ra2` reading `len` elements from offset `ofs1` and writing them to `ofs2`, possibly adding elements at the end of `ra2`. **Raises** `Invalid_argument` if `ofs1` and `len` do not designate a valid subarray of `ra1` or if `ofs2` is larger than the length of `ra2`.

Combining resizable arrays

`val append : 'a t -> 'a t -> 'a t`

`append ra1 ra2`

**Returns** a new resizable array using the default strategy and copying `ra1` and `ra2` in this order onto it.

`val concat : 'a t list -> 'a t`

`concat l`

**Returns** a new resizable array using the default strategy and copying all resizable arrays in `l` in their respective order onto it.

Adding and removing elements

```
val add_one : 'a t -> 'a option -> unit
```

`add_one ra el` adds element `el` to resizable array `ra`, possibly causing a reallocation.

```
val remove_one : 'a t -> unit
```

`remove_one ra` removes the last element of resizable array `ra`, possibly causing a reallocation.

**Raises** `Failure` if the array is empty.

```
val remove_n : 'a t -> int -> unit
```

`remove_n ra n` removes the last `n` elements of resizable array `ra`, possibly causing a reallocation.

**Raises** `Invalid_arg` if there are not enough elements or `n < 0`.

```
val remove_range : 'a t -> int -> int -> unit
```

`remove_range ra ofs len` removes `len` elements from resizable array `ra` starting at `ofs` and possibly causing a reallocation.

**Raises** `Invalid_argument` if range is invalid.

```
val clear : 'a t -> unit
```

`clear ra` removes all elements from resizable array `ra`, possibly causing a reallocation.

Swapping

```
val swap : 'a t -> int -> int -> unit
```

`swap ra n m` swaps elements at indices `n` and `m`.

**Raises** `Invalid_argument` if any index is out of range.

```
val swap_in_last : 'a t -> int -> unit
```

`swap_in_last ra n` swaps the last element with the one at position `n`.

**Raises** `Invalid_argument` if index `n` is out of range.

Standard conversions

```
val to_std : 'a t -> 'a Weak.t
```

`to_std ra` converts a resizable weak array to a standard one.

```
val sof_std : strategy -> 'a Weak.t -> 'a t
```

`sof_std s ar` converts a standard weak array to a resizable one, using strategy `s`.

```
val of_std : 'a Weak.t -> 'a t
```

`of_std ar` converts a standard weak array to a resizable one using the default strategy.

List conversions

```
val to_list : 'a t -> 'a option list
```

`to_list ra` converts resizable array `ra` to a list.

```
val of_list : 'a option list -> 'a t
```

`of_list l` creates a resizable array using the default strategy and the elements in list `l`.

Iterators

```
val iter : ('a option -> unit) -> 'a t -> unit
```

`iter f ra` applies the unit-function `f` to each element in resizable array `ra`.

```
val iteri : (int -> 'a option -> unit) -> 'a t -> unit
```

`iteri f ra` applies the unit-function `f` to each index and element in resizable array `ra`.

```
val fold_left : ('b -> 'a option -> 'b) -> 'b -> 'a t -> 'b
```

`fold_left f a ra` left-folds values in resizable array `ra` using function `f` and start accumulator `a`.

```
val fold_right : ('a option -> 'b -> 'b) -> 'a t -> 'b -> 'b
```

`fold_right f a ra` right-folds values in resizable array `ra` using function `f` and start accumulator `a`.

Scanning of resizable arrays

```
val for_all : ('a option -> bool) -> 'a t -> bool
```

`for_all p ra`

**Returns** `true` if all elements in resizable array `ra` satisfy the predicate `p`, `false` otherwise.

```
val exists : ('a option -> bool) -> 'a t -> bool
```

`exists p ra`

**Returns** `true` if at least one element in resizable array `ra` satisfies the predicate `p`, `false` otherwise.

```
val mem : 'a option -> 'a t -> bool
```

`mem el ra`

**Returns** `true` if element `el` is logically equal to any element in resizable array `ra`, `false` otherwise.

```
val memq : 'a option -> 'a t -> bool
```

`memq el ra`

**Returns** `true` if element `el` is physically equal to any element in resizable array `ra`, `false` otherwise.

`val pos : 'a option -> 'a t -> int option`

`pos el ra`

**Returns** `Some index` if `el` is logically equal to the element at `index` in `ra`, `None` otherwise. `index` is the index of the first element that matches.

`val posq : 'a option -> 'a t -> int option`

`posq el ra`

**Returns** `Some index` if `el` is physically equal to the element at `index` in `ra`, `None` otherwise. `index` is the index of the first element that matches.

Searching of resizable arrays

`val find : ('a option -> bool) -> 'a t -> 'a option`

`find p ra`

**Raises** `Not_found` if there is no such element.

**Returns** the first element in resizable array `ra` that satisfies predicate `p`.

`val find_index : ('a option -> bool) -> 'a t -> int -> int`

`find_index p ra pos`

**Raises**

- `Not_found` if there is no such element or if `pos` is larger than the highest index.
- `Invalid_argument` if `pos` is negative.

**Returns** the index of the first element that satisfies predicate `p` in resizable array `ra`, starting search at index `pos`.

`val filter : ('a option -> bool) -> 'a t -> 'a t`

`filter p ra`

**Returns** a new resizable array by filtering out all elements in `ra` that satisfy predicate `p` using the same strategy as `ra`.

`val find_all : ('a option -> bool) -> 'a t -> 'a t`

`find_all p ra` is the same as `filter`

`val filter_in_place : ('a option -> bool) -> 'a t -> unit`

`filter_in_place p ra` as `filter`, but filters in place.

`val partition : ('a option -> bool) ->`

`'a t -> 'a t * 'a t`

```
partition p ra
```

**Returns** a pair of resizable arrays, the left part containing only elements of **ra** that satisfy predicate **p**, the right one only those that do not satisfy it. Both returned arrays are created using the strategy of **ra**.

### UNSAFE STUFF - USE WITH CAUTION!

```
val unsafe_get : 'a t -> int -> 'a option
val unsafe_set : 'a t -> int -> 'a option -> unit
val unsafe_sub : 'a t -> int -> int -> 'a t
val unsafe_fill : 'a t -> int -> int -> 'a option -> unit
val unsafe_blit : 'a t -> int -> 'a t -> int -> int -> unit
val unsafe_remove_one : 'a t -> unit
val unsafe_remove_n : 'a t -> int -> unit
val unsafe_swap : 'a t -> int -> int -> unit
val unsafe_swap_in_last : 'a t -> int -> unit
end
```

## 5 Module Res : Global module for resizable datastructures and default implementations

Default strategies

```
module DefStrat :
```

```
  Strat.T with type t = float * float * int
```

Default strategy for resizable datastructures

**type t** is a triple **waste**, **shrink\_trig**, **min\_size**, where **waste** (default: 1.5) indicates by how much the array should be grown in excess when reallocation is triggered, **shrink\_trig** (default: 0.5) at which percentage of excess elements it should be shrunk and **min\_size** (default: 16 elements) is the minimum size of the resizable array.

```
module BitDefStrat :
```

```
  Strat.T with type t = float * float * int
```

Same as **DefStrat**, but the minimum size is 1024 elements (bits).

Default instantiation of standard resizable datastructures

```
module Array :
```

```
  Pres_intf.T with module Strategy = DefStrat
```

Resizable parameterized array using the default reallocation strategy.

```
module Floats :
```

```
  Nopres_intf.T with module Strategy = DefStrat and type el = float
```

Resizable float array using the default reallocation strategy.

```
module Bits :
```

```
  Nopres_intf.T with module Strategy = BitDefStrat and type el = bool
```

Resizable bit vector using the default reallocation strategy.

```
module Weak :
```

```
  Weak_intf.T with module Strategy = DefStrat
```

Resizable weak array using the default reallocation strategy.

```
module Buffer :
```

```
  Nopres_intf.Buffer with module Strategy = DefStrat and type el = char
```

Resizable buffer using the default reallocation strategy.

Functors for creating standard resizable datastructures from strategies

```
module MakeArray :
```

```
  functor (S : Strat.T) -> Pres_intf.T with module Strategy = S
```

Functor that creates resizable parameterized arrays from reallocation strategies.

```
module MakeFloats :
```

```
  functor (S : Strat.T) -> Nopres_intf.T with module Strategy = S and type el = float
```

Functor that creates resizable float arrays from reallocation strategies.

```
module MakeBits :
```

```
  functor (S : Strat.T) -> Nopres_intf.T with module Strategy = S and type el = bool
```

Functor that creates resizable bit vectors from reallocation strategies.

```
module MakeWeak :
```

```
  functor (S : Strat.T) -> Weak_intf.T with module Strategy = S
```

Functor that creates resizable weak arrays from reallocation strategies.

```
module MakeBuffer :
```

```
  functor (S : Strat.T) -> Nopres_intf.Buffer with module Strategy = S and type el  
= char
```

Functor that creates resizable buffers (=string arrays) from reallocation strategies.