



NICE ELKS 2000 proposal

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NICE ELKS 2000

Welcome! This official NICE page hosts the ELKS 2000 initial and current proposals.

In 1995, [NICE \(The Non-Profit International Consortium for Eiffel\)](#) adopted the [ELKS'95 standard](#) for Eiffel kernel libraries. Since then, and despite the fact it was supposed to be updated each year and although it was considered by many as an imperfect standard, ELKS had not evolved beyond ELKS'95.

In July 1999, Emmanuel Stapf (from ISE) and Dominique Colnet and Olivier Zendra (both from the SmallEiffel team) met in Nancy, France, and worked on a much-needed proposal (limited to ARRAY and STRING) to try and get ELKS evolving a bit. This [initial ELKS 2000 draft proposal](#) was then submitted for review to other Eiffel experts, then to a meeting in TOOLS USA.

It is now discussed in the NICE mailing list dedicated to library issues,
<http://www.egroups.com/group/eiffel-nice-library>.

This site gives acces to the following ressources:

[current_array.html](#)

The current state of the ELKS 2000 proposal for ARRAY.

[current_string.html](#)

The current state of the ELKS 2000 proposal for STRING.

[elks2000init.html](#)

The initial ELKS 2000 proposal.

[inital_array.html](#)

The initial ELKS 2000 proposal for ARRAY.

[inital_string.html](#)

The initial ELKS 2000 proposal for STRING.

[changelog.html](#)

The list of changes between the initial and the current ELKS 2000 proposals.

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Maintainers: Dominique Colnet and Olivier Zendra.

Last Update: 20 August 1999.

5.12 Class ARRAY (current ELKS2000 status)

[Please don't report broken URLs because this page is still a draft.]

indexing

description: "Resizable sequences of values, all of the same type or of a %
%conforming one, accessible through integer indices in a %
%contiguous interval"

class interface

ARRAY [G]

creation

```
make (minindex, maxindex: INTEGER)
  -- Allocate array; set index interval to
  -- minindex .. maxindex; set all values to default.
  -- (Make array empty if minindex > maxindex.)
  require
    valid_indices: (minindex <= maxindex) or (maxindex = minindex - 1)
  ensure
    lower_set: lower = minindex
    upper_set: upper = maxindex
    -- array_set: for i in minindex..maxindex, item(i) = default item
```

```
make_from_array (a: ARRAY [G])
  -- Initialize from the items of a.
  -- (Useful in proper descendants of class ARRAY,
  -- to initialize an array-like object from a manifest array.)
  require
```

```
    valid_array: a /= Void
```

feature -- Initialization

```
make (minindex, maxindex: INTEGER)
  -- Set index interval to minindex .. maxindex;
  -- reallocate if necessary; set all values to default.
  -- (Make array empty if minindex > maxindex.)
  require
    valid_indices: (minindex <= maxindex) or (maxindex = minindex - 1)
  ensure
    lower_set: lower = minindex
    upper_set: upper = maxindex
    -- array_set: for i in minindex..maxindex, item(i) = default item
```

```
make_from_array (a: ARRAY [G])
  -- Initialize from the items of a; reallocate if
  -- necessary. (Useful in proper descendants of
  -- class ARRAY, to initialize an array-like object
  -- from a manifest array.)
  require
```

```
    valid_array: a /= Void
```

feature -- Access

```
first: like item
  -- First element
  require
    not_empty: not is_empty
  ensure
    definition: Result = item (lower)
```

```
has (v: like item): BOOLEAN
  -- Does Current contain v?
  -- Use equal as comparison operator.
  ensure
    definition: Result = valid_index(index_of(c));
```

```

index_of (v: like item): INTEGER
  -- Index of first occurrence of v
  -- Use equal as comparison operator.
  -- Upper + 1 if not found
ensure
  not_found: (Result = upper + 1) = not has(v);
  found: has(v) implies equal(v, item(Result));

infix "@", item (i: INTEGER): G
  -- Entry at index i
require
  good_key: valid_index (i)

last: like item
  -- Last element
require
  not_empty: not is_empty
ensure
  definition: Result = item (upper)

reverse_index_of (v: like item): INTEGER
  -- Index of last occurrence of v?
  -- Use equal as comparison operator.
  -- Lower - 1 if not found
ensure
  not_found: (Result = upper + 1) = not has(v);
  found: has(v) implies equal(v, item(Result));

```

feature -- Measurement

```

capacity: INTEGER
  -- Number of elements that Current can currently contain in the internal storage
  -- Automatically updated when resizing is needed. Useful for fine tuning.

count: INTEGER
  -- Number of valid indices
ensure
  definition: Result = upper - lower + 1;

lower: INTEGER
  -- Minimum valid index

occurrences (v: like item): INTEGER
  -- Number of times v appears in Current.
  -- Use equal as comparison operator.
ensure
  non_negative_occurrences: Result >= 0

upper: INTEGER
  -- Maximum valid index

```

feature -- Comparison

```

is_equal (other: like Current): BOOLEAN
  -- Do both arrays have same lower, upper and
  -- items (compared with is_equal)?
  -- (Redefined from GENERAL.)

```

feature -- Status report

```

is_empty: BOOLEAN
  -- Is array empty?
ensure
  definition: Result = (count = 0)

valid_index (i: INTEGER): BOOLEAN
  -- Is i within the bounds of the array?
ensure
  definition: lower <= i and i <= upper

```

feature -- Element change

```

add (v: like item; i: INTEGER)
  -- Insert v at index i, shifting elements between ranks i and upper rightwards.

```

```

require
  valid_insertion_index: lower <= i and i <= upper + 1
ensure
  inserted: item (i) = v;
  same_lower: lower = old lower;
  higher_upper: upper = old upper + 1

add_first (v: like item)
  -- Insert v at index lower, shifting all elements rightwards.
  ensure
    inserted: first = v;
    same_lower: lower = old lower;
    higher_upper: upper = old upper + 1

add_last (v: like item)
  -- Append v at end.
  ensure
    inserted: last = v;
    same_lower: lower = old lower;
    higher_upper: upper = old upper + 1

force (v: like item; i: INTEGER)
  -- Assign v to i-th entry.
  -- Always applicable: resize the array if i falls out of
  -- currently defined bounds; preserve existing items.
  -- New entries if any are initialized to default value.
  ensure
    put: item (i) = v;
    higher_count: count >= old count

put (v: like item; i: INTEGER)
  -- Assign v to i-th entry.
  require
    good_index: valid_index (i)
  ensure
    put: item (i) = v

feature -- Removal

remove (i: INTEGER)
  -- Remove element at index i and shift elements between ranks i+1 and upper left
  require
    good_index: valid_index (i)
  ensure
    same_lower: lower = old lower;
    smaller_upper: upper = old upper - 1

remove_first
  -- Remove first element and shift all elements leftwards.
  require
    not_is_empty: not is_empty
  ensure
    same_lower: lower = old lower;
    smaller_upper: upper = old upper - 1

remove_last
  -- Remove last element.
  require
    not_is_empty: not is_empty
  ensure
    same_lower: lower = old lower;
    smaller_upper: upper = old upper - 1

wipe_out
  -- Remove all elements.
  ensure
    is_empty: is_empty
    same_capacity: capacity = old capacity
    same_lower: lower = old lower

feature -- Resizing

resize (minindex, maxindex: INTEGER)

```

```

-- Rearrange array so that it can accommodate
-- indices down to minindex and up to maxindex.
-- Do not lose any previously entered item in the
-- intersection between [old lower .. old upper] and
-- [minindex .. maxindex].
-- New positions are initialized to their default value.
require
  valid_indices: (minindex <= maxindex) or (maxindex = minindex - 1)
ensure
  lower_set: lower = minindex
  upper_set: upper = maxindex

```

feature -- Conversion

```

to_external: POINTER
-- Address of the storage area containing the actual sequence of elements,
-- to be passed to some external (non-Eiffel) routine.
-- Keep in mind that this storage area is subject to garbage collection.

```

feature -- Duplication

```

copy (other: like Current)
-- Reinitialize by copying all the items of other.
-- Shallow copy: if the elements are references, only the references
-- are copied, not the object they point to.
-- (Redefined from GENERAL.)
ensure
  same_lower: lower = other.lower;
  same_upper: upper = other.upper;
  -- same_content: For every i in lower..upper,
  --   item (i) = other.item (i)

```

feature -- Indexing

```

reindex (new_lower: INTEGER)
-- Change bounds according to new_lower, keeping same size and contents.
ensure
  reindexed_lower: lower = new_lower;
  same_contents: count = old count;

```

feature -- Optimization

```

adjust_capacity (n: INTEGER)
-- Rearrange array so that it can accommodate
-- at least n elements.
-- Do not loose any previously entered element.
require
  no_item_lost: n >= count
ensure
  enough_capacity: capacity >= n

```

invariant

```

consistent_count: count = upper - lower + 1;
non_negative_count: count >= 0;
good_capacity: capacity >= count

```

end

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Last Updated: 01 September 1999

5.13 Class STRING (current ELKS2000 status)

[Please don't report broken URLs because this page is still a draft.]

indexing

*description: "Resizable sequences of characters, accessible through %
%integer indices in a contiguous range. If not empty, first element%
%is at index 1."*

class interface

STRING

creation

```
make (n: INTEGER)
  -- Allocate space for at least n characters.
  require
    non_negative_size: n >= 0
  ensure
    empty_string: count = 0
    correctly_allocated_size: capacity >= n

make_from_external (ptr: POINTER)
  -- Set Current with a copy of the content of ptr.
  -- Assume ptr is a null-terminated memory area containing
  -- only characters.
  -- The extra null character is not part of the Eiffel string
  require
    ptr_exists: ptr /= default_pointer

make_from_string (s: STRING)
  -- Initialize from the characters of s.
  -- (Useful in proper descendants of class STRING,
  -- to initialize a string-like object from a manifest string.)
  require
    string_exists: s /= Void
  ensure
    count_set: count = s.count
```

feature -- Initialization

```
make (n: INTEGER)
  -- Allocate space for at least n characters.
  require
    non_negative_size: n >= 0
  ensure
    empty_string: count = 0
    correctly_allocated_size: capacity >= n

make_from_external (ptr: POINTER)
  -- Set Current with a copy of the content of ptr.
  -- Assume ptr is a null-terminated memory area containing
  -- only characters.
  -- The extra null character is not part of the Eiffel string
  require
    ptr_exists: ptr /= default_pointer

make_from_string (s: STRING)
  -- Initialize from the characters of s.
  -- (Useful in proper descendants of class STRING,
  -- to initialize a string-like object from a manifest string.)
  require
    string_exists: s /= Void
  ensure
    count_set: count = s.count
```

feature -- Access

```

first: CHARACTER
  -- First character of Current.
  require
    not_empty_string: not is_empty
  ensure
    good_result: Result = item (1)

has (c: CHARACTER): BOOLEAN
  -- Does Current contain c ?
  ensure
    definition: Result = (index_of(c) /= 0);

hash_code: INTEGER
  -- Hash code value
  -- (From HASHABLE.)
  ensure
    good_hash_value: Result >= 0

index_from (c: CHARACTER; start_index: INTEGER): INTEGER
  -- Index of first occurrence of c at or after start_index;
  -- 0 if none.
  require
    valid_start_index: valid_index (start_index)
  ensure
    non_negative_result: Result >= 0;
    valid_result: Result > 0 implies valid_index (Result)
    result_after_start_index: Result > 0 implies Result >= start_index;
    at_this_index: Result > 0 implies item (Result) = c;
    -- none_before: For every i in start_index..Result-1, item (i) /= c
    -- zero_iff_absent:
    --   (Result = 0) = For every i in start_index..count, item (i) /= c

index_of (c: CHARACTER): INTEGER
  -- Index of first occurrence of c;
  -- 0 if none.
  ensure
    empty_definition: empty implies Result = 0;
    non_empty_definition: not empty implies Result = index_from (c, 1);

infix "@", item (i: INTEGER): CHARACTER
  -- Character at index i
  require
    good_key: valid_index (i)

last: CHARACTER
  -- Last character of Current.
  require
    not_empty_string: not is_empty
  ensure
    good_result: Result = item (count)

reverse_index_from (c: CHARACTER; last_index: INTEGER): INTEGER
  -- Index of first occurrence of c at or before last_index;
  -- 0 if none.
  require
    valid_last_index: valid_index (last_index)
  ensure
    non_negative_result: Result >= 0;
    valid_result: Result > 0 implies valid_index(Result)
    result_before_last_index: Result <= last_index;
    at_this_index: Result > 0 implies item (Result) = c;
    -- none_before: Result > 0 implies For every i in Result+1..last_index, item (i) /= c
    -- zero_iff_absent:
    --   (Result = 0) = For every i in 1..last_index, item (i) /= c

reverse_index_of (c: CHARACTER): INTEGER
  -- Index of last occurrence of c;
  -- 0 if none.
  ensure
    empty_definition: empty implies Result = 0;
    non_empty_definition: empty implies Result = reverse_index_from (c, count);

reverse_string_index_from (other: STRING; last_index: INTEGER): INTEGER

```

```

-- Index of first occurrence of other at or before last_index;
-- 0 if none.
require
  other_not_empty: not other.empty;
  valid_last_index: valid_index (last_index)
ensure
  non_negative_result: Result >= 0;
  valid_result: Result > 0 implies valid_index (Result)
  result_before_last_index: Result > 0 implies Result <= last_index;
  at_this_index: Result > 0 implies other.is_equal (substring (Result, Result - 1
-- none_before: Result > 0 implies
--   For every i in Result+1..last_index, not other.is_equal (substring (i, i
-- zero_iff_absent:
--   (Result = 0) = For every i in 1..last_index, not other.is_equal (substri

reverse_string_index_of (other: STRING): INTEGER
-- Index of last occurrence of other;
-- 0 if none.
require
  other_not_empty: not other.empty
ensure
  empty_definition: empty implies Result = 0;
  non_empty_definition: not empty implies Result = reverse_string_index_from (oth

string_index_from (other: STRING; start_index: INTEGER): INTEGER
-- Index of first occurrence of other at or after start;
-- 0 if none.
require
  other_not_empty: not other.empty;
  valid_start_index: valid_index (start_index)
ensure
  non_negative_result: Result >= 0;
  valid_result: Result > 0 implies valid_index (Result)
  result_after_start_index: Result > 0 implies Result >= start_index;
  at_this_index: Result > 0 implies other.is_equal (substring (Result, Result - 1
-- none_before:
--   For every i in start_index..Result-1, not other.is_equal (substring (i, i
-- zero_iff_absent:
--   (Result = 0) = For every i in start_index..count, not other.is_equal (su

string_index_of (other: STRING): INTEGER
-- Index of first occurrence of other;
-- 0 if none.
require
  other_not_empty: not other.empty
ensure
  empty_definition: empty implies Result = 0;
  non_empty_definition: not empty implies Result = reverse_string_index_from (oth

```

feature -- Measurement

```

count: INTEGER
-- Current number of characters making up the string

capacity: INTEGER
-- Number of characters that Current can currently contain in the internal stor
-- Automatically updated when resizing is needed. Useful for fine tuning.

occurrences (c: CHARACTER): INTEGER
-- Number of times c appears in the string
ensure
  non_negative_occurrences: Result >= 0

```

feature -- Comparison

```

is_equal (other: like Current): BOOLEAN
-- Is string made of same character sequence as other?
-- (Redefined from GENERAL.)
require
  other_exists: other /= Void

infix "<" (other: like Current): BOOLEAN
-- Is string lexicographically lower than other?

```

```

    -- (False if other is void)
    -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  asymmetric: Result implies not (other ≤ Current)

infix "<=" (other: like Current): BOOLEAN
  -- Is current object less than or equal to other?
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  definition: Result = (Current ≤ other) or is\_equal (other);

infix ">=" (other: like Current): BOOLEAN
  -- Is current object greater than or equal to other?
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  definition: Result = (other ≤ Current)

infix ">" (other: like Current): BOOLEAN
  -- Is current object greater than other?
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  definition: Result = (other ≤ Current)

max (other: like Current): like Current
  -- The greater of current object and other
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  current_if_not_smaller: (Current ≥ other) implies (Result = Current)
  other_if_smaller: (Current ≤ other) implies (Result = other)

min (other: like Current): like Current
  -- The smaller of current object and other
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  current_if_not_greater: (Current ≤ other) implies (Result = Current)
  other_if_greater: (Current ≥ other) implies (Result = other)

same_as (other: STRING): BOOLEAN
  -- Is string made of same character sequence as other?
  -- Case insensitive comparison.
require
  other_exists: other /= Void

three_way_comparison (other: like Current): INTEGER
  -- If current object equal to other, 0; if smaller,
  -- -1; if greater, 1.
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  equal_zero: (Result = 0) = is\_equal (other);
  smaller: (Result = -1) = Current < other;
  greater_positive: (Result = 1) = Current > other

feature -- Status report

is_empty: BOOLEAN
  -- Is string empty?
ensure
  definition: Result = (count = 0)

```

```

valid_index (index: INTEGER): BOOLEAN
  -- Is i within the bounds of the string?
  ensure
    definition: Result = (1 <= index and index <= count)

is_boolean: BOOLEAN
  -- Is Current representing a boolean ("true" or "false" with no
  -- case consideration)?

is_double: BOOLEAN
  -- Can Current be read as a DOUBLE?

is_integer: BOOLEAN
  -- Can Current be read as an INTEGER?

is_real: BOOLEAN
  -- Can Current be read as a REAL?

feature -- Element change

add, insert (c: CHARACTER; i: INTEGER)
  -- Insert c at index i, shifting characters between ranks i and count rightward:
  require
    valid_insertion_index: 1 <= i and i <= count + 1
  ensure
    inserted: item (i) = c
    one_more_character: count = old count + 1

add_first, precede (c: CHARACTER)
  -- Prepend c at beginning.
  ensure
    inserted: first = c
    one_more_character: count = old count + 1

add_last, append_character, extend (c: CHARACTER)
  -- Append c at end.
  ensure
    inserted: last = c
    one_more_character: count = old count + 1

append, append_string (s: STRING)
  -- Append a copy of s at end.
  require
    other_exists: s /= Void
  ensure
    new_count: count = old count + old s.count
    -- appended: For every i in 1.. old s.count,
    --           item (old count + i) = s.item (i)

append_boolean (b: BOOLEAN)
  -- Append the string representation of b at end.
  ensure
    boolean_inserted: reverse_index_of (b.out) = count - b.out.count
    new_count: count = old count + b.out.count + 1

append_double (d: DOUBLE)
  -- Append the string representation of d at end.
  ensure
    double_inserted: reverse_index_of (d.out) = count - d.out.count
    new_count: count = old count + d.out.count + 1

append_integer (i: INTEGER)
  -- Append the string representation of i at end.
  ensure
    integer_inserted: reverse_index_of (i.out) = count - i.out.count
    new_count: count = old count + i.out.count + 1

append_real (r: REAL)
  -- Append the string representation of r at end.
  ensure
    real_inserted: reverse_index_of (r.out) = count - r.out.count
    new_count: count = old count + r.out.count + 1

fill (c: CHARACTER)

```

```

    -- Replace every character with c.
ensure
  same_count: old count = count
  filled: occurrences(c) = count

head (n: INTEGER)
  -- Remove all characters except for the first n;
  -- do nothing if n >= count.
require
  non_negative_argument: n >= 0
ensure
  new_count: count = n.min (old count)
  -- first_kept: For every i in 1..n, item (i) = old item (i)

insert_string (s: like Current; i: INTEGER)
  -- Insert s at index i, shifting characters between ranks i and count rightward:
require
  string_exists: s /= Void;
  valid_insertion_index: 1 <= i and i <= count + 1
ensure
  new_count: count = old count + old s.count
  inserted: s.is_equal (substring (i, i - 1 + old s.count))

left_adjust
  -- Remove leading white space.
ensure
  shorter: count <= old count
  first_not_white_space: not is_empty implies ("%T%R%N ").index_of (first) = 0

put (c: CHARACTER; i: INTEGER)
  -- Replace character at index i by c.
require
  good_key: valid_index (i)
ensure
  insertion_done: item (i) = c

right_adjust
  -- Remove trailing white space.
ensure
  shorter: count <= old count
  last_not_white_space: not is_empty implies ("%T%R%N ").index_of (last) = 0

subcopy (other: like Current; start_pos, end_pos, from_index: INTEGER) is
  -- Copy characters of other within bounds start_pos and
  -- end_pos to current string starting at index from_index.
require
  other_not_void: other /= Void;
  valid_start_pos: other.valid_index (start_pos)
  valid_end_pos: other.valid_index (end_pos)
  valid_bounds: start_pos <= end_pos
  valid_from_index: valid_index (from_index)
  enough_space: valid_index (from_index + end_pos - start_pos)
ensure
  same_count: old count = count
  copied: substring (from_index, from_index + end_pos - start_pos).is_equal
    (other.substring (start_pos, end_pos))

tail (n: INTEGER)
  -- Remove all characters except for the last n;
  -- do nothing if n >= count.
require
  non_negative_argument: n >= 0
ensure
  new_count: count = n.min (old count)

feature -- Removal

remove (i: INTEGER)
  -- Remove i-th character, shifting characters between ranks i + 1 and count le:
require
  valid_removal_index: valid_index (i)
ensure
  new_count: count = old count - 1

```

```

wipe_out
    -- Remove all characters.
    ensure
        empty_string: is_empty
        same_capacity: capacity = old capacity
        same_lower: lower = old lower

feature -- Conversion

to_boolean: BOOLEAN
    -- Boolean value;
    -- "true" yields true, "false" yields false
    -- (case-insensitive)
    require
        is_boolean: is_boolean

to_double: DOUBLE
    -- Double value; for example, when applied to "123.0",
    -- will yield 123.0 (double)
    require
        is_double: is_integer or is_real or is_double

to_external: POINTER
    -- Address of the storage area containing the actual sequence of characters,
    -- to be passed to some external (non-Eiffel) routine.
    -- Keep in mind that this storage area is subject to garbage collection.

to_integer: INTEGER
    -- Integer value;
    -- for example, when applied to "123", will yield 123
    require
        is_integer: is_integer

to_lower
    -- Convert to lower case.

to_real: REAL
    -- Real value;
    -- for example, when applied to "123.0", will yield 123.0
    require
        is_real: is_integer or is_real

to_upper
    -- Convert to upper case.

feature -- Duplication

copy (other: like Current)
    -- Reinitialize by copying the characters of other.
    -- (From GENERAL.)
    ensure
        new_result_count: count = other.count
        -- same_characters: For every i in 1..count,
        --     item (i) = other.item (i)

infix "+" (other: STRING): like Current
    -- Create a new object which is the concatenation of Current and other.
    require
        other_exists: other /= Void
    ensure
        result_count: Result.count = count + other.count

substring (start_index, end_index: INTEGER): like Current
    -- Create a substring containing all characters from start_index
    -- to end_pos included.
    require
        valid_start_index: valid_index (start_index)
        valid_end_index: valid_index (end_index)
        meaningful_interval: start_index <= end_index
    ensure
        new_result_count: Result.count = end_index - start_index + 1
        -- original_characters: For every i in 1..end_index - start_index + 1,
        --     Result.item (i) = item (start_index + i - 1)

```

feature -- Output

```

out: STRING
    -- Printable representation
    -- (From GENERAL.)
ensure
    result_not_void: Result /= Void
    duplicated_result: Result /= Current and Result.is_equal (Current)

```

feature -- Optimization

```

adjust_capacity (n: INTEGER)
    -- Rearrange string so that it can accommodate
    -- at least n characters.
    -- Do not lose any previously entered character.
require
    no_item_lost: n >= count
ensure
    enough_capacity: capacity >= n

```

invariant

```

non_negative_count: count >= 0
capacity_big_enough: capacity >= count

```

end

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Last Updated: 15 September 1999

ELKS 2000 initial proposal

Content

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Preamble

This work is a **proposal** for the new standard ELKS for two classes: ARRAY and STRING.

It is not intended to be the whole new standard, but only **part of it**. Indeed, because ELKS hasn't evolved at all since 1995, we decided to invest a reasonable but limited amount of time and work to see whether it was possible to make things go ahead a bit.

If, **after discussions and possibly modifications**, this proposal for ARRAY and STRING is **officially accepted in a reasonable amount of time and published** by NICE as part of the new standard (which would be the first evolution since 1995...), we will continue working on other classes and topics for the new standard. Otherwise, we will, as most people so far who have been trying to improve ELKS, consider we have wasted our time and efforts and give up.

This work is mostly considered as a (major) **cleanup of ELKS'95 for ARRAY and STRING**, not as an extension to it. Once good basis are agreed on, extensions may be discussed more easily.

(This preamble was written by Dominique Colnet and Olivier Zendra, from the SmallEiffel team. As far as we know, these views are shared by Emmanuel Stapf, from ISE. However, since he could not take part in writing this, neither him or ISE are committed by this.)

In Progress for the new standard

STRING (Note: this list may be incomplete. [initial_string.html](#) is the actual reference.)

1. Introduced [capacity](#).
2. [make](#) is not frozen anymore.
3. Removed [remake](#) and [resize](#).
4. Renamed [empty](#) into [is_empty](#).
5. Reviewed most of the assertions to use [valid_index](#) instead of the explicite use of the comparison of index to 1 and count.
6. Renamed [from_c](#) into [make_from_external](#)
7. Added a new creation procedure [make_from_external](#) and [to_external](#)
8. Introduced a new set of routines to do some string search based on character/string search from with/without a start/last index which can do the search from the beginning or from the end:
 - [index_from](#)
 - [index_of](#)
 - [reverse_index_from](#)
 - [reverse_string_index_of](#)
 - [reverse_index_of](#)
 - [reverse_string_index_from](#)
 - [string_index_from](#)
 - [string_index_of](#)
9. Changed the post-conditions of [left_adjust](#) and [right_adjust](#) which were completely wrong.
10. Removed [put_substring](#) and replace it by [subcopy](#) a multipurpose string routine manipulation with a clear comment.
11. Changed [insert](#) and [insert_character](#) into [insert_string](#) and [insert](#). Clarified the purpose of those two

- features. Added [add](#) as a synonym of [insert](#).
12. Introduced [adjust_capacity](#) which replaces [resize](#) with a more explicit meaning.
 13. Introduced [first](#) and [last](#) to get the first and the last character of a STRING.
 14. New STRING class invariant: [capacity](#) >= [count](#).
 15. Added post-conditions to the [append *](#) features.
 16. Added [extend](#) and [add_last](#) as a synonym of [append_character](#) and [append](#) as a synonym of [append_string](#).
 17. Added [is_boolean](#), [is_integer](#), [is_real](#) and [is_double](#) features.
 18. Added [same_as](#) which does a case insensitive comparison between two strings.
 19. Added [add_first](#) and [precede](#).
 20. Added [infix +](#) to append two strings.

ARRAY (Note: this list may be incomplete. [initial_array.html](#) is the actual reference.)

1. Removed [entry](#) and [enter](#).
 2. [item](#), [put](#) and [@](#) are not frozen anymore.
 3. Changed the assertions of [make](#).
 4. Added a precondition to [make_from_array](#).
 5. Added [capacity](#) and the class invariant [capacity](#) >= [count](#).
 6. Changed the definition of [resize](#).
 7. Use of [equal](#) as comparison operator for the new search algorithms ([has](#), [index_of](#), [reverse_index_of](#))
 8. Removed ambiguity on [is_equal](#) and [copy](#)
 9. Renamed [to_c](#) into [to_external](#).
 10. Added [is_empty](#), [occurrences](#), [first](#) and [last](#).
 11. Added [add](#), [add_first](#) and [add_last](#).
 12. Added [remove](#), [remove_first](#) and [remove_last](#).
-

Off standard for the time being

MANIFEST_STRING or CONSTANT_STRING

Very important language/libraries issues were also discussed about the semantics of STRING. In a nutshell, there are two problems:

1. The current semantics of an instruction such as

```
foo := "FOO";
```

is not very clear and various compilers have different implementation for this. Some create a new object, other consider this instruction as a call to a once function (like for the declaration `foo: STRING is "FOO";`). This at least must be clarified.
2. STRINGS are mutable. Adding immutable (constant) strings would be a significant improvement, both in terms of performance (potential optimizations) and expressiveness (and safety).

After discussing this, it seem that the correct implementation in the long term would be the following:

1. Mutable STRINGS and immutable CONSTANT_STRING (or another name).
2. "FOO" is the notation for a CONSTANT_STRING.
3. It must be possible to compare two CONSTANT_STRINGs with '=' with the same semantics as [is_equal](#).

NATIVE_ARRAY

Aside the high-level, flexible, ARRAY class, it seems important to provide a standard low-level, C-like, array for optimal performances, like the `NATIVE_ARRAY[E]` class provided with SmallEiffel.

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People Behind

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Last Update: 20 August 1999.

5.12 Class ARRAY (initial ELKS2000 proposal)

[Please don't report broken URLs because this page is a draft.]

indexing

description: "Resizable sequences of values, all of the same type or of a %
%conforming one, accessible through integer indices in a %
%contiguous interval"

class interface

ARRAY [G]

creation

```
make (minindex, maxindex: INTEGER)
  -- Allocate array; set index interval to
  -- minindex .. maxindex; set all values to default.
  -- (Make array empty if minindex > maxindex.)
  require
    valid_indices: (minindex <= maxindex) or (maxindex = minindex - 1)
  ensure
    lower_set: lower = minindex
    upper_set: upper = maxindex
    -- array_set: for i in minindex..maxindex, item(i) = default item
```

```
make_from_array (a: ARRAY [G])
  -- Initialize from the items of a.
  -- (Useful in proper descendants of class ARRAY,
  -- to initialize an array-like object from a manifest array.)
  require
```

```
    valid_array: a /= Void
```

feature -- Initialization

```
make (minindex, maxindex: INTEGER)
  -- Set index interval to minindex .. maxindex;
  -- reallocate if necessary; set all values to default.
  -- (Make array empty if minindex > maxindex.)
  require
    valid_indices: (minindex <= maxindex) or (maxindex = minindex - 1)
  ensure
    lower_set: lower = minindex
    upper_set: upper = maxindex
    -- array_set: for i in minindex..maxindex, item(i) = default item
```

```
make_from_array (a: ARRAY [G])
  -- Initialize from the items of a; reallocate if
  -- necessary. (Useful in proper descendants of
  -- class ARRAY, to initialize an array-like object
  -- from a manifest array.)
  require
```

```
    valid_array: a /= Void
```

feature -- Access

```
first: like item
  -- First element
  require
    not_empty: not is_empty
  ensure
    definition: Result = item (lower)
```

```
has (v: like item): BOOLEAN
  -- Does Current contain v?
  -- Use equal as comparison operator.
  ensure
    definition: Result = valid_index(index_of(c));
```

```

index_of (v: like item): INTEGER
  -- Index of first occurrence of v
  -- Use equal as comparison operator.
  -- Upper + 1 if not found
  ensure
    not_found: (Result = upper + 1) = not has(v);
    found: has(v) implies equal(v, item(Result));

infix "@", item (i: INTEGER): G
  -- Entry at index i
  require
    good_key: valid_index (i)

last: like item
  -- Last element
  require
    not_empty: not is_empty
  ensure
    definition: Result = item (upper)

reverse_index_of (v: like item): INTEGER
  -- Index of last occurrence of v?
  -- Use equal as comparison operator.
  -- Lower - 1 if not found
  ensure
    not_found: (Result = upper + 1) = not has(v);
    found: has(v) implies equal(v, item(Result));

```

feature -- Measurement

```

capacity: INTEGER
  -- Current number of elements that Current can contain.

count: INTEGER
  -- Number of valid indices
  ensure
    definition: Result = upper - lower + 1;

lower: INTEGER
  -- Minimum valid index

occurrences (v: like item): INTEGER
  -- Number of times v appears in Current.
  -- Use equal as comparison operator.
  ensure
    non_negative_occurrences: Result >= 0

upper: INTEGER
  -- Maximum valid index

```

feature -- Comparison

```

is_equal (other: like Current): BOOLEAN
  -- Do both arrays have same lower, upper and
  -- items (compared with is_equal)?
  -- (Redefined from GENERAL.)

```

feature -- Status report

```

is_empty: BOOLEAN
  -- Is array empty?
  ensure
    definition: Result = (count = 0)

valid_index (i: INTEGER): BOOLEAN
  -- Is i within the bounds of the array?
  ensure
    definition: lower <= i and i <= upper

```

feature -- Element change

```

add (v: like item; i: INTEGER)
  -- Insert v at index i, shifting elements between ranks i and upper rightwards.
  require

```

```

    valid_insertion_index: lower <= i and i <= upper + 1
  ensure
    inserted: item (i) = v;
    same_lower: lower = old lower;
    higher_upper: upper = old upper + 1

add_first (v: like item)

  -- Insert v at index lower, shifting all elements rightwards.
  ensure
    inserted: first = v;
    same_lower: lower = old lower;
    higher_upper: upper = old upper + 1

add_last (v: like item)
  -- Append v at end.
  ensure
    inserted: last = v;
    same_lower: lower = old lower;
    higher_upper: upper = old upper + 1

force (v: like item; i: INTEGER)
  -- Assign v to i-th entry.
  -- Always applicable: resize the array if i falls out of
  -- currently defined bounds; preserve existing items.
  -- New entries if any are initialized to default value.
  ensure
    put: item (i) = v;
    higher_count: count >= old count

put (v: like item; i: INTEGER)
  -- Assign v to i-th entry.
  require
    good_index: valid_index (i)
  ensure
    put: item (i) = v

feature -- Removal

remove (i: INTEGER)
  -- Remove element at index i and shift elements between ranks i+1 and upper left
  require
    good_index: valid_index (i)
  ensure
    same_lower: lower = old lower;
    smaller_upper: upper = old upper - 1

remove_first
  -- Remove first element and shift all elements leftwards.
  require
    not_is_empty: not is_empty
  ensure
    same_lower: lower = old lower;
    smaller_upper: upper = old upper - 1

remove_last
  -- Remove last element.
  require
    not_is_empty: not is_empty
  ensure
    same_lower: lower = old lower;
    smaller_upper: upper = old upper - 1

wipe_out
  -- Remove all elements.
  ensure
    is_empty: is_empty
    same_capacity: capacity = old capacity

feature -- Resizing

resize (minindex, maxindex: INTEGER)

```

```

-- Rearrange array so that it can accommodate
-- indices down to minindex and up to maxindex.
-- Do not lose any previously entered item in the
-- intersection between [old lower .. old upper] and
-- [minindex .. maxindex].
-- New positions are initialized to their default value.
require
  valid_indices: (minindex <= maxindex) or (maxindex = minindex - 1)
ensure
  lower_set: lower = minindex
  upper_set: upper = maxindex

```

feature -- Conversion

```

to_external: POINTER
  -- Address of the storage area containing the actual sequence of elements,
  -- to be passed to some external (non-Eiffel) routine.
  -- Keep in mind that this storage area is subject to garbage collection.

```

feature -- Duplication

```

copy (other: like Current)
  -- Reinitialize by copying all the items of other.
  -- Shallow copy: if the elements are references, only the references
  -- are copied, not the object they point to.
  -- (Redefined from GENERAL.)
ensure
  same_lower: lower = other.lower;
  same_upper: upper = other.upper;
  -- same_content: For every i in lower..upper,
  --   item (i) = other.item (i)

```

invariant

```

consistent_count: count = upper - lower + 1;
non_negative_count: count >= 0;
good_capacity: capacity >= count

```

end

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Last Updated: 20 August 1999

5.13 Class STRING (initial ELKS2000 proposal)

[Please don't report broken URLs because this page is a draft.]

indexing

description: "Resizable sequences of characters, accessible through %
%integer indices in a contiguous range. If not empty, first element%
%is at index 1."

class interface

STRING

creation

```
make (n: INTEGER)
  -- Allocate space for at least n characters.
  require
    non_negative_size: n >= 0
  ensure
    empty_string: count = 0
    correctly_allocated_size: capacity >= n

make_from_external (ptr: POINTER)
  -- Set Current with a copy of the content of ptr.
  -- Assume ptr is a null-terminated memory area containing
  -- only characters.
  -- The extra null character is not part of the Eiffel string
  require
    ptr_exists: ptr /= default_pointer

make_from_string (s: STRING)
  -- Initialize from the characters of s.
  -- (Useful in proper descendants of class STRING,
  -- to initialize a string-like object from a manifest string.)
  require
    string_exists: s /= Void
  ensure
    count_set: count = s.count
```

feature -- Initialization

```
make (n: INTEGER)
  -- Allocate space for at least n characters.
  require
    non_negative_size: n >= 0
  ensure
    empty_string: count = 0
    correctly_allocated_size: capacity >= n

make_from_external (ptr: POINTER)
  -- Set Current with a copy of the content of ptr.
  -- Assume ptr is a null-terminated memory area containing
  -- only characters.
  -- The extra null character is not part of the Eiffel string
  require
    ptr_exists: ptr /= default_pointer

make_from_string (s: STRING)
  -- Initialize from the characters of s.
  -- (Useful in proper descendants of class STRING,
  -- to initialize a string-like object from a manifest string.)
  require
    string_exists: s /= Void
  ensure
    count_set: count = s.count
```

feature -- Access

```

first: CHARACTER
  -- First character of Current.
  require
    not_empty_string: not is_empty
  ensure
    good_result: Result = item (1)

has (c: CHARACTER): BOOLEAN
  -- Does Current contain c ?
  ensure
    definition: Result = (index_of(c) /= 0);

hash_code: INTEGER
  -- Hash code value
  -- (From HASHABLE.)
  ensure
    good_hash_value: Result >= 0

index_from (c: CHARACTER; start_index: INTEGER): INTEGER
  -- Index of first occurrence of c at or after start_index;
  -- 0 if none.
  require
    valid_start_index: valid_index (start_index)
  ensure
    non_negative_result: Result >= 0;
    valid_result: Result > 0 implies valid_index (Result)
    result_after_start_index: Result > 0 implies Result >= start_index;
    at_this_index: Result > 0 implies item (Result) = c;
    -- none_before: For every i in start_index..Result, item (i) /= c
    -- zero_iff_absent:
    --   (Result = 0) = For every i in start_index..count, item (i) /= c

index_of (c: CHARACTER): INTEGER
  -- Index of first occurrence of c;
  -- 0 if none.
  ensure
    empty_definition: empty implies Result = 0;
    non_empty_definition: not empty implies Result = index_from (c, 1);

infix "@", item (i: INTEGER): CHARACTER
  -- Character at index i
  require
    good_key: valid_index (i)

last: CHARACTER
  -- Last character of Current.
  require
    not_empty_string: not is_empty
  ensure
    good_result: Result = item (count)

reverse_index_from (c: CHARACTER; last_index: INTEGER): INTEGER
  -- Index of first occurrence of c at or before last_index;
  -- 0 if none.
  require
    valid_last_index: valid_index (last_index)
  ensure
    non_negative_result: Result >= 0;
    valid_result: Result > 0 implies valid_index (Result)
    result_before_last_index: Result <= last_index;
    at_this_index: Result > 0 implies item (Result) = c;
    -- none_before: For every i in Result..last_index, item (i) /= c
    -- zero_iff_absent:
    --   (Result = 0) = For every i in 1..last_index, item (i) /= c

reverse_index_of (c: CHARACTER): INTEGER
  -- Index of last occurrence of c;
  -- 0 if none.
  ensure
    empty_definition: empty implies Result = 0;
    non_empty_definition: empty implies Result = reverse_index_from (c, count);

reverse_string_index_from (other: STRING; last_index: INTEGER): INTEGER

```

```

-- Index of first occurrence of other at or before last_index;
-- 0 if none.
require
  other_not_empty: not other.empty;
  valid_last_index: valid_index (last_index)
ensure
  non_negative_result: Result >= 0;
  valid_result: Result > 0 implies valid_index (Result)
  result_before_last_index: Result > 0 implies Result <= last_index;
  at_this_index: Result > 0 implies other.is_equal (substring (Result, Result - 1
-- none_before:
--   For every i in Result..last_index, not other.is_equal (substring (i, i -
-- zero_iff_absent:
--   (Result = 0) = For every i in 1..last_index, not other.is_equal (substri

reverse_string_index_of (other: STRING): INTEGER
-- Index of last occurrence of other;
-- 0 if none.
require
  other_not_empty: not other.empty
ensure
  empty_definition: empty implies Result = 0;
  non_empty_definition: not empty implies Result = reverse_string_index_from (other

string_index_from (other: STRING; start_index: INTEGER): INTEGER
-- Index of first occurrence of other at or after start;
-- 0 if none.
require
  other_not_empty: not other.empty;
  valid_start_index: valid_index (start_index)
ensure
  non_negative_result: Result >= 0;
  valid_result: Result > 0 implies valid_index (Result)
  result_after_start_index: Result > 0 implies Result >= start_index;
  at_this_index: Result > 0 implies other.is_equal (substring (Result, Result - 1
-- none_before:
--   For every i in start_index..Result, not other.is_equal (substring (i, i
-- zero_iff_absent:
--   (Result = 0) = For every i in start_index..count, not other.is_equal (sub

string_index_of (other: STRING): INTEGER
-- Index of first occurrence of other;
-- 0 if none.
require
  other_not_empty: not other.empty
ensure
  empty_definition: empty implies Result = 0;
  non_empty_definition: not empty implies Result = reverse_string_index_from (other

feature -- Measurement

count: INTEGER
-- Current number of characters making up the string

capacity: INTEGER
-- Current number of characters that the string
-- can contain.

occurrences (c: CHARACTER): INTEGER
-- Number of times c appears in the string
ensure
  non_negative_occurrences: Result >= 0

feature -- Comparison

is_equal (other: like Current): BOOLEAN
-- Is string made of same character sequence as other?
-- (Redefined from GENERAL.)
require
  other_exists: other /= Void

infix "<" (other: like Current): BOOLEAN
-- Is string lexicographically lower than other?

```

```

    -- (False if other is void)
    -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  asymmetric: Result implies not (other ≤ Current)

infix "<=" (other: like Current): BOOLEAN
  -- Is current object less than or equal to other?
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  definition: Result = (Current ≤ other) or is_equal (other);

infix ">=" (other: like Current): BOOLEAN
  -- Is current object greater than or equal to other?
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  definition: Result = (other ≤ Current)

infix ">" (other: like Current): BOOLEAN
  -- Is current object greater than other?
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  definition: Result = (other ≤ Current)

max (other: like Current): like Current
  -- The greater of current object and other
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  current_if_not_smaller: (Current ≥ other) implies (Result = Current)
  other_if_smaller: (Current ≤ other) implies (Result = other)

min (other: like Current): like Current
  -- The smaller of current object and other
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  current_if_not_greater: (Current ≤ other) implies (Result = Current)
  other_if_greater: (Current ≥ other) implies (Result = other)

same_as (other: STRING): BOOLEAN
  -- Is string made of same character sequence as other?
  -- Case insensitive comparison.
require
  other_exists: other /= Void

three_way_comparison (other: like Current): INTEGER
  -- If current object equal to other, 0; if smaller,
  -- -1; if greater, 1.
  -- (From COMPARABLE.)
require
  other_exists: other /= Void
ensure
  equal_zero: (Result = 0) = is_equal (other);
  smaller: (Result = -1) = Current < other;
  greater_positive: (Result = 1) = Current > other

feature -- Status report

  is_empty: BOOLEAN
    -- Is string empty?
    ensure
      definition: Result = (count = 0)

```

```

valid_index (index: INTEGER): BOOLEAN
  -- Is i within the bounds of the string?
  ensure
    definition: Result = (1 <= index and index <= count)

is_boolean: BOOLEAN
  -- Is Current representing a boolean ("true" or "false" with no
  -- case consideration)?

is_double: BOOLEAN
  -- Can Current be read as a DOUBLE?

is_integer: BOOLEAN
  -- Can Current be read as an INTEGER?

is_real: BOOLEAN
  -- Can Current be read as a REAL?

feature -- Element change

add, insert (c: CHARACTER; i: INTEGER)
  -- Insert c at index i, shifting characters between ranks i and count rightward:
  require
    valid_insertion_index: 1 <= i and i <= count + 1
  ensure
    inserted: item (i) = c
    one_more_character: count = old count + 1

add_first, precede (c: CHARACTER)
  -- Prepend c at beginning.
  ensure
    inserted: first = c
    one_more_character: count = old count + 1

add_last, append_character, extend (c: CHARACTER)
  -- Append c at end.
  ensure
    inserted: last = c
    one_more_character: count = old count + 1

append, append_string (s: STRING)
  -- Append a copy of s at end.
  require
    other_exists: s /= Void
  ensure
    new_count: count = old count + s.count
    -- appended: For every i in 1.. s.count,
    --           item (old count + i) = s.item (i)

append_boolean (b: BOOLEAN)
  -- Append the string representation of b at end.
  ensure
    boolean_inserted: reverse_index_of (b.out) = count - b.out.count
    new_count: count = old count + b.out.count + 1

append_double (d: DOUBLE)
  -- Append the string representation of d at end.
  ensure
    double_inserted: reverse_index_of (d.out) = count - d.out.count
    new_count: count = old count + d.out.count + 1

append_integer (i: INTEGER)
  -- Append the string representation of i at end.
  ensure
    integer_inserted: reverse_index_of (i.out) = count - i.out.count
    new_count: count = old count + i.out.count + 1

append_real (r: REAL)
  -- Append the string representation of r at end.
  ensure
    real_inserted: reverse_index_of (r.out) = count - r.out.count
    new_count: count = old count + r.out.count + 1

fill (c: CHARACTER)

```

```

    -- Replace every character with c.
ensure
  same_count: old count = count
  filled: occurrences(c) = count

head (n: INTEGER)
  -- Remove all characters except for the first n;
  -- do nothing if n >= count.
require
  non_negative_argument: n >= 0
ensure
  new_count: count = n.min (old count)
  -- first_kept: For every i in 1..n, item (i) = old item (i)

insert_string (s: like Current; i: INTEGER)
  -- Insert s at index i, shifting characters between ranks i and count rightward:
require
  string_exists: s /= Void;
  valid_insertion_index: 1 <= i and i <= count + 1
ensure
  new_count: count = old count + s.count
  inserted: s.is_equal (substring (i, i - 1 + s.count))

left_adjust
  -- Remove leading white space.
ensure
  shorter: count <= old count
  first_not_white_space: not is_empty implies ("%T%R%N ").index_of (first) = 0

put (c: CHARACTER; i: INTEGER)
  -- Replace character at index i by c.
require
  good_key: valid_index (i)
ensure
  insertion_done: item (i) = c

right_adjust
  -- Remove trailing white space.
ensure
  shorter: count <= old count
  last_not_white_space: not is_empty implies ("%T%R%N ").index_of (last) = 0

subcopy (other: like Current; start_pos, end_pos, from_index: INTEGER) is
  -- Copy characters of other within bounds start_pos and
  -- end_pos to current string starting at index from_index.
require
  other_not_void: other /= Void;
  valid_start_pos: other.valid_index (start_pos)
  valid_end_pos: other.valid_index (end_pos)
  valid_bounds: start_pos <= end_pos
  valid_from_index: valid_index (from_index)
  enough_space: valid_index (from_index + end_pos - start_pos)
ensure
  same_count: old count = count
  copied: substring (from_index, from_index + end_pos - start_pos).is_equal
    (other.substring (start_pos, end_pos))

tail (n: INTEGER)
  -- Remove all characters except for the last n;
  -- do nothing if n >= count.
require
  non_negative_argument: n >= 0
ensure
  new_count: count = n.min (old count)

feature -- Removal

remove (i: INTEGER)
  -- Remove i-th character, shifting characters between ranks i + 1 and count le:
require
  valid_removal_index: valid_index (i)
ensure
  new_count: count = old count - 1

```

```

wipe_out
  -- Remove all characters.
  ensure
    empty_string: is_empty
    same_capacity: capacity = old capacity

feature -- Resizing

adjust_capacity (n: INTEGER)
  -- Rearrange string so that it can accommodate
  -- at least n characters.
  -- Do not lose any previously entered character.
  require
    no_item_lost: n >= count
  ensure
    enough_capacity: capacity >= n

feature -- Conversion

to_boolean: BOOLEAN
  -- Boolean value;
  -- "true" yields true, "false" yields false
  -- (case-insensitive)
  require
    is_boolean: is_boolean

to_double: DOUBLE
  -- Double value; for example, when applied to "123.0",
  -- will yield 123.0 (double)
  require
    is_double: is_integer or is_real or is_double

to_external: POINTER
  -- Address of the storage area containing the actual sequence of characters,
  -- to be passed to some external (non-Eiffel) routine.
  -- Keep in mind that this storage area is subject to garbage collection.

to_integer: INTEGER
  -- Integer value;
  -- for example, when applied to "123", will yield 123
  require
    is_integer: is_integer

to_lower
  -- Convert to lower case.

to_real: REAL
  -- Real value;
  -- for example, when applied to "123.0", will yield 123.0
  require
    is_real: is_integer or is_real

to_upper
  -- Convert to upper case.

feature -- Duplication

copy (other: like Current)
  -- Reinitialize by copying the characters of other.
  -- (From GENERAL.)
  ensure
    new_result_count: count = other.count
    -- same_characters: For every i in 1..count,
    --   item (i) = other.item (i)

infix "+" (other: STRING): like Current
  -- Create a new object which is the concatenation of Current and other.
  require
    other_exists: other /= Void
  ensure
    result_count: Result.count = count + other.count

substring (start_index, end_index: INTEGER): like Current

```

```

    -- Create a substring containing all characters from start_index
    -- to end_pos included.
require
  valid_start_index: valid_index (start_index)
  valid_end_index: valid_index (end_index)
  meaningful_interval: start_index <= end_index
ensure
  new_result_count: Result.count = end_index - start_index + 1
  -- original_characters: For every i in 1..end_index - start_index + 1,
  --   Result.item (i) = item (start_index + i - 1)

feature -- Output

  out: STRING
    -- Printable representation
    -- (From GENERAL.)
  ensure
    result_not_void: Result /= Void
    duplicated_result: Result /= Current and Result.is_equal (Current)

invariant

  non_negative_count: count >= 0
  capacity_big_enough: capacity >= count

end

```

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ELKS 2000 proposal changelog

Preamble

This page lists the changes made to the initial ELKS2000 proposal ([initial_string.html](#) and [initial_array.html](#)) to obtain the current ELKS2000 proposal ([current_string.html](#) and [current_array.html](#)).

These changes result from the discussions in the NICE mailing list dedicated to library issues, <http://www.egroups.com/group/eiffel-nice-library>.

Of course, only those changes that have been agreed upon are put in here.

Changes (latest first)

15 September 1999:

- Fixed postcondition of `append`, `append_string` and `insert_string` in `STRING`.

01 September 1999:

- Moved `adjust_capacity` from Resizing feature clause to Optimization feature clause in `ARRAY` and `STRING`.
- Added `reindex` feature in class `ARRAY`.

30 August 1999:

- Updated comments for `capacity` in `ARRAY` and `STRING`.
- Made postcondition `same_lower` explicit in `wipe_out` of `ARRAY` and `STRING`.

20 August 1999:

- Added these ELKS2000 pages.
 - Added `adjust_capacity` in `ARRAY` (was mistakenly forgotten in the initial proposal), like in `STRING`.
 - Fixed mistakes in postcondition `--none_before`: for routines `index_from`, `string_index_from`, `reverse_index_from`, and `reverse_string_index_from` of class `STRING`.
-

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Maintainers: Dominique Colnet.

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